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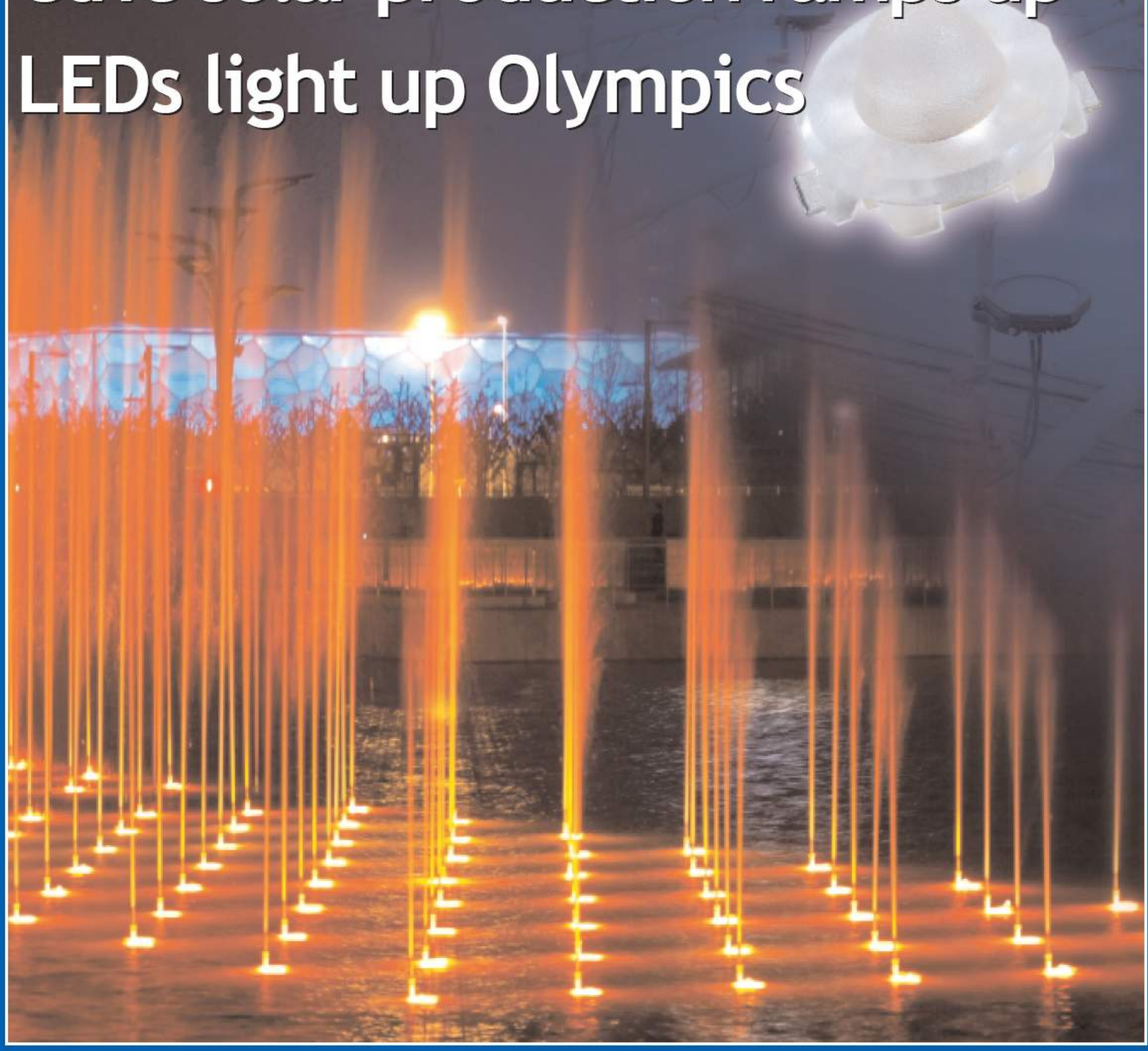
CdTe solar production ramps up

LEDs light up Olympics



Anadigics reverses fab acceleration • Avago files $400m IPO
NREL ups PV efficiency record • Riber buys OIPT's MBE unit

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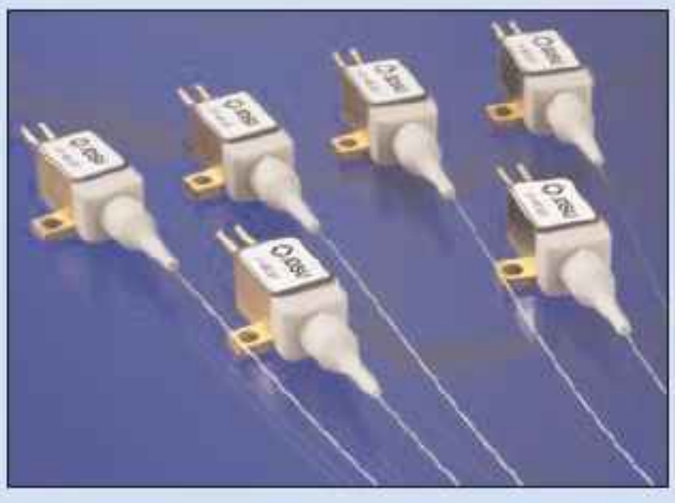
p12 Veeco's new FastFlex web-coating system for manufacturing flexible CIGS PV modules.

p30 Monocrystal's new 8-inch sapphire wafer for LED applications (right) compared to a standard 2-inch sapphire wafer (left).



p61 JDSU's 6398 L4i series, the first diode lasers with fiber-laser power feedback protection.

Cover: Water fountains extending in a dragon shape 600m through Beijing's Olympic Park: 1920 water jets are each lit by 24 Osram Opto Golden Dragon LEDs from (46,080 LEDs in total). Also, the 'Water Cube' National Aquatic Center in the background was lit by 496,000 XLamp LEDs from Cree. **p42**

editorial

Growing pains and inventory corrections

Boosted by cell-phone handset sales that topped 300m, second-quarter 2008 saw healthy year-on-year revenue growth for GaAs RFIC makers (pages 10–17). But while Skyworks, TriQuint and Anadigics increased their profits, RFMD reported a net loss up from Q1/2008. However, this is due to charges from restructuring its Wireless Systems Group; otherwise, underlying income grew. In contrast, despite broadband sales helping Anadigics to a 13th consecutive quarter of growth, wireless revenue fell. Nevertheless, due to increased design-in activity, in July CEO Bami Bastani announced a doubling of investment in its 6" GaAs fab in Kunshan, China to accelerate its build-out. Yet, just three weeks later, due to "a further weakening in demand from wireless handset customers" Anadigics cut back its Q3 revenue guidance by 18% (to down 19–23% on Q2) and reversed the decision to accelerate the fab build-out.

The drop in demand stems from capacity constraints in late 2007 for handset components such as power amplifiers at Anadigics' fab in Warren, NJ, leading it to place customers on allocation. In subsequently building inventory as a safeguard, customers over-ordered, and have since needed to burn off excess inventory, confounding Anadigics expectations that demand would continue to grow. Also, some customers have turned to secondary suppliers for both existing designs and for future designs. Anadigics has consequently lost market share with some key customers (e.g. losing key reference designs with Qualcomm, with whom it previously had a 'most favored' partner relationship).

A potential future rival to GaAs RFIC makers is Peregrine Semiconductor, which in July shipped its 300 millionth RFIC using its silicon-on-sapphire technology and began transitioning from 6" to 8" substrates, supplied by Rubicon (see page 41). Similarly to Anadigics, after revenue growth of 40% year-on-year in Q2/2008 (due largely to Peregrine), Rubicon reiterated its 2008 growth forecast of 38–44%, despite some build-up of inventory in the silicon-on-sapphire market. However, shortly before we went to press, Rubicon slashed its 2008 growth forecast to 22–24% due to push-outs in orders from 2008 to 2009 both for Peregrine (which is outsourcing more to its foundry partner Oki, which has also been building inventory) and for small-diameter (2") LED wafers (due to the economic downturn slowing demand for small displays and consumer handheld devices).

However, demand for large-diameter sapphire for higher-growth LED applications continues to be strong, says Peregrine. Likewise, Russian sapphire substrate maker Monocrystal has also started producing 8"-diameter wafers for LEDs and RFICs, reflecting growing demand for larger-diameter substrates as manufacturers transition from 2–4" wafers. So, while inventory corrections for small-diameter materials may have an impact short-term, demand for larger-diameter applications offers prospects for growth longer-term, especially as LED backlighting is adopted by display manufacturers.

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***Semiconductor Today* covers the R&D and manufacturing of compound semiconductor and advanced silicon materials and devices** (e.g. GaAs, InP and SiGe wafers, chips and modules for microelectronic and optoelectronic devices such as RFICs, lasers and LEDs in wireless and optical communications, etc).

Regular issues contain:
- news (funding, personnel, facilities, technology, applications and markets);
- feature articles (technology, markets, regional profiles);
- conference reports;
- event calendar and event previews;
- suppliers' directory.

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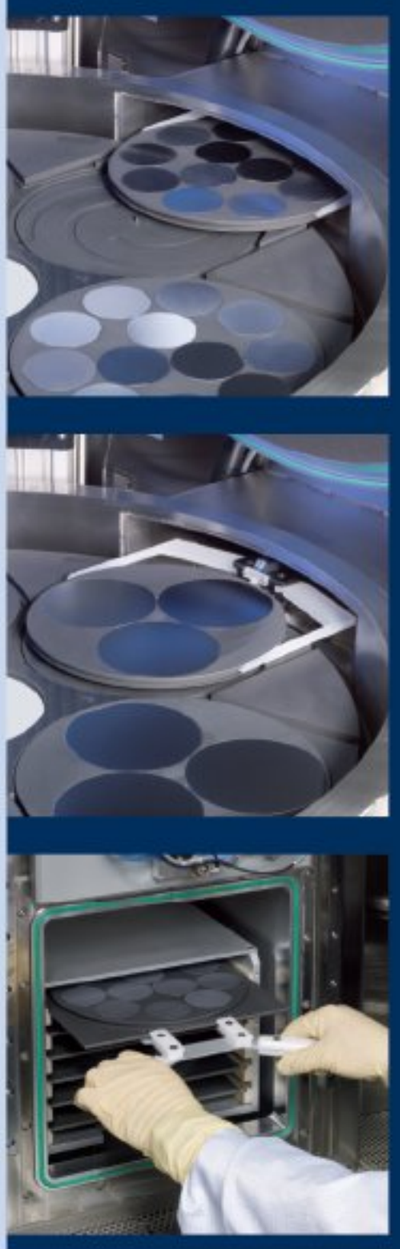

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news

VCSEL transceivers to grow at 24.5% to $1.1bn in 2012

The worldwide consumption value of optical communication transceivers based on vertical-cavity surface-emitting lasers (VCSELs) reached $376m in 2007, and should increase at an average annual growth rate of 24.5% to $1.1bn in 2012, according to a new forecast and analysis of global market consumption and technology trends from ElectroniCast Consultants.

"Strong growth in VCSEL transceiver use is occurring in <10 Gigabit Ethernet and 1–2Gb/s Fibre Channel; this transceiver grouping is forecasted to show triple (3x) growth by 2012," says Stephen Montgomery, president of ElectroniCast Consultants — APAC. "The increased production of VCSEL transceivers is fueling development of 10 Gigabit VCSELs, multi-wavelength CWDM [coarse wavelength division multiplexing] VCSEL transceivers, long-wavelength single-mode VCSELs, and opening new opportunities for these standards-based applications," he adds.

Very-short-reach (SONET VSR) module based on VCSEL transceivers are forecast to grow strongly in value terms, while the growth of 10 Gigabit Ethernet from 2007–2012 will boost the Ethernet category even higher in 2012. "Use of VCSEL transceivers in military/aerospace applications continues to show strong growth; however, the near-term VCSEL transceiver growth leader will be intra-system links, such as telecom serial links, optical array interconnect/optical backplanes, and Infiniband," Montgomery concludes.

www.electronicastconsultants.com

More GaAs integration needed as CMOS PA challenge multiplies

The number of firms developing CMOS power amplifiers (PAs) for cell phones is increasing, according to the report 'PA Technology Trends: 2008 – 2013' from the Strategy Analytics RF & Wireless Components market research service. Work by more than 20 firms will lead to simplified multi-band, multi-standard front ends, potentially reducing the cost of cell phones while potentially disrupting established suppliers.

So far, CMOS silicon has captured a miniscule share of the PA market compared to gallium arsenide and LDMOS silicon. However, even in mainstream PA modules based on GaAs and LDMOS RF power elements, suppliers increasingly add CMOS support chips for linearity-efficiency management and control, which leads to the prospect of replacing entire conventional PA front-end modules from established suppliers with a potentially lower-cost monolithic PA solution in CMOS or silicon germanium (SiGe) BiCMOS from a host of chipset suppliers and start-ups. New technologies, such as MEMS tunable elements, could enable this transition.

"The GaAs PA suppliers have stayed well ahead of CMOS PA firms by responding quickly to market needs, and by developing improved fabrication processes, filters, complex RF switches, and low-cost packaging techniques to put these together in modules," notes the report's author Chris Taylor. As the market for cellular terminals matures, mainstream PA vendors will develop more sophisticated dual-mode and tunable GaAs and LDMOS-based PA modules for higher-data-rate, multi-band wireless handsets and mobile devices. "As we foresee the industry roadmap unfolding over the next five years in response to market needs, the GaAs and LDMOS PA suppliers will maintain this lead," he adds.

Asif Anwar, director of Strategy Analytics' GaAs and Compound Semiconductor program, comments, "It is crucial that GaAs vendors continue to improve the monolithic integration supported by GaAs for cellular PAs, otherwise CMOS will eventually replace GaAs, as it did about a decade ago in handset transceivers."

www.strategyanalytics.com

Optical transport market grows 13%

The optical transport equipment market grew to a new quarterly record of $3.5bn in Q2/2008, according to the Dell'Oro Group's Optical Transport Quarterly Report. "The optical equipment market had another strong quarter with revenues growing 13%, far exceeding expectations," says Jimmy Yu, director of Optical Transport research. With the exception of North America, all regions reported sequential growth in optical revenue, with Asia–Pacific growing the most strongly. The top vendors were Alcatel–Lucent, Huawei and Nortel, garnering nearly 50% of market share collectively.

DWDM equipment sales continued their growth, at a rate of 24%, as service providers increased their installation of long-haul capacity and 40Gb/s wavelengths, Yu says.

There are six vendors shipping 40Gb/s wavelengths, still led by Nokia Siemens Networks, with Nortel close behind in second. In addition, Ciena and Nortel continue to ship naked-40Gb/s long-haul systems, where the transponder is not located in the vendor's DWDM terminal, but rather in a core router such as Cisco's CRS-1, Yu adds.

www.DellOro.com

SI GaAs epi market to grow 7% in 2008 then 10% in 2009

Market research firm Strategy Analytics' prediction that IQE plc of Cardiff, UK would secure the top spot as a merchant supplier of both MOCVD and MBE material has been confirmed by it taking 36% of the market in 2007, according to Strategy Analytics' report 'Markets for SI GaAs Epitaxial Substrates: 2007–2012'. IQE was propelled to the number one position in terms of both material output and revenue by its acquisitions of the epiwafer foundries MBE Technology Pte Ltd in Singapore and Emcore's Electronic Materials & Device division in Somerset, NJ, USA (now IQE RF LLC).

It was also a milestone year for Taiwanese epiwafer foundry Visual Photonics Epitaxy Co Ltd (VPEC), as it edged ahead of Japan's Hitachi Cable in terms of total material output to the merchant market in 2007. However, Kopin remained the world's number one supplier of SI (semi-insulating) GaAs MOCVD epitaxial substrates. In the merchant SI GaAs MBE epitaxial substrate market, Intelligent Epitaxy Technology Inc (IntelliEPI) of Richardson, TX, USA pushed ahead of Soitec subsidiary, Picogiga International S.A.S. near Paris, France, by 3 percentage points in 2007.

"With strong strategic relationships in place, market leaders like IQE and Kopin will benefit from continued demand for SI GaAs epitaxial substrates, despite the macroeconomic concerns surrounding end markets for GaAs," predicts Asif Anwar, director of the GaAs service at Strategy Analytics. "Demand for SI GaAs epitaxial substrates will grow by 7% year-on-year in 2008 and then 10% year-on-year in 2009," he adds.

"Captive production of epitaxial substrates at GaAs device manufacturers remains significant, accounting for 30% of total material output in 2007," Anwar notes. "Despite strong growth for the merchant vendors, we believe that, overall, RFMD will continue to be the world's largest producer of SI GaAs epitaxial substrates."

GaAs microelectronics market to slow from 17% in 2007 to 9% in 2008

Year-on-year growth in the GaAs industry will slow from 17% in 2007 (when it reached $3.6bn) to 9% in 2008 ($3.9bn), predicts market research firm Strategy Analytics in its annual five-year outlook for the gallium arsenide microelectronics industry 'GaAs Industry Forecast 2007–2012' (which covers the vertical GaAs market supply chain, from bulk substrates through to epitaxial substrates to MMICs and discrete and digital ICs).

However, the study maintains previous guidance on long-term growth, and the market will break the $5bn barrier in 2011. Overall, the GaAs device market will grow at a compound annual average growth rate (CAAGR) of 9% through 2012.

Demand from cellular handsets will continue to be the primary growth engine for the GaAs industry, with Wi-Fi the second largest market. The corresponding market for GaAs (bulk and epitaxial) substrates will be worth $492m in 2012, with demand for six-inch diameter material bolstered by an expected decline in four-inch material use.

"In line with previous analysis, wireless infrastructure, satellite and DBS [direct broadcast satellite] markets will drive demand for GaAs discretes, though the overall market will show only a 1% CAAGR from 2007 to 2012," notes Asif Anwar, director of the Strategy Analytics GaAs and Compound Semiconductor Technologies service. "Meanwhile, the market for digital GaAs ICs actually showed year-on-year growth for the first time in several years as a result of demand from the 10Gb/s fiber-optic markets," he adds.

The GaAs device market will grow at a CAAGR of 9% through 2012

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GaAs wafer vendors rated

According to a customer satisfaction survey by market research firm Strategy Analytics, no single GaAs epitaxial substrate supplier was rated highly enough to satisfy both the technical and commercial requirements of end users. While Hitachi Cable had the highest satisfaction rating for technical parameters, especially with the wafer and lot uniformity, VPEC, Kopin and IQE lead GaAs epitaxial customer satisfaction on price, lead time, delivery and responsiveness to complaints.

GaAs bulk substrate end users continued to express high levels of satisfaction with both Hitachi Cable and Freiberger Compound Materials (FCM). AXT ranked alongside Hitachi Cable and FCM, with strong customer satisfaction across both technical and commercial parameters. AXT was rated highly for the price, surface finish and flatness of its wafers, adds Strategy Analytics.

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Broadcast RF power semi market double its assumed size

The global market for RF power semiconductors used in broadcasting is much larger than years of 'conventional wisdom' have suggested, according to a new report 'RF Power Semiconductors for Broadcast Applications' from ABI Research. Its growth is being driven by the current explosion in digital broadcasting (both TV and radio, but especially TV). The market is expected to remain very healthy for the next decade.

"Historically, this market has been viewed as flat and not very exciting," says research director Lance Wilson. "In general, most RF power semiconductor vendors have overlooked and dismissed it. That, it turns out, is a grave error," he reckons. "This market has never been comprehensively examined, and we found that it is much bigger — approximately twice the size — than suggested by the conventional wisdom."

Some analog TV services are starting to decline somewhat, but the total demand for RF power semiconductors for broadcasting looks very promising for the next 10 years, ABI forecasts. Regionally, growth will be driven by the phased switchover to digital TV as it occurs in different countries.

Part of the reason for earlier inaccurate assessments of the market has been that many of these semiconductors have been sold through electronic component distribution sales channels, making it difficult to know where the parts are going. These channels have now been factored into the market forecast.

"Historically this market favored well-established incumbents," says Wilson. "But it's not at all an adverse environment for new entrants if performance and pricing goals are met."

www.abiresearch.com

Compound semiconductor market to grow at 17.3% to $33.7bn by 2012

The compound semiconductor market should rise at a compound annual growth rate (CAGR) of 17.3% from $16bn in 2007 to $33.7bn in 2012, according to the report 'Compound Semiconductor Materials: Technology, Developments and Markets' from BCC Research.

Wireless electronic devices should grow at 10.8% from $5.7bn (the largest market share) to $9.6bn; illumination at 4.2% from $1.9bn to $2.3bn; optical data storage at 15.8% from $1.65bn to $3.4bn; fiber-optic communications at 39.5% from $1.15bn to $6.1bn; new markets at 34.8% from $0.9bn to $4bn; solar cells at 85% from $90m (the smallest market share) to $1.95bn; and other compound semiconductors at 6.7% from $4.6bn (the second largest market share) to $6.4bn.

BCC stresses that, although compound semiconductors currently represent just 6% of total semiconductor revenues, it is growing about 50% faster than the semiconductor industry overall, and should almost double its share of total revenues by 2012.

www.bccresearch.com

Compound semiconductor market to 2012 ($bn).

	2007	2012	CAGR
Wireless electronic devices	5.72	9.55	10.8%
Optical data storage	1.65	3.43	15.8%
Fiber-optic communications	1.15	6.07	39.5%
Illumination	1.90	2.33	4.2%
PVs (terrestrial)	0.09	1.95	85.0%
New markets	0.90	4.00	34.8%
Other	4.61	6.38	6.7%
Total	**16.02**	**33.71**	**17.3%**

Cellular backhaul to drive point-to-point radio shipments to 1.5m units

Point-to-point radio shipments are set to increase at a compound annual average growth rate (CAAGR) of 8% to more than 1.5m units in 2012, predicts market research firm Strategy Analytics in its new report 'Point-to-Point Radio GaAs Market 2007–2012'.

The main market for point-to-point radios will continue to be cellular backhaul, with other applications such as trunking, enterprise and public safety making up the balance. Cellular backhaul shipments will be driven by wireless network expansions, as cellular subscriber rates grow and existing links are replaced to accommodate the higher bandwidth requirements of next-generation networks. On a regional basis, Asia-Pacific, Middle East, Africa and other emerging markets will drive the bulk of demand.

"GaAs component demand is skewed towards MMIC solutions, with some limited demand for discretes as well," says Asif Anwar, director of Strategy Analytics GaAs service. "Despite the increase in unit demand, ASP pressures will mean the market for GaAs devices will be effectively flat over 2008 and 2009."

"While Strategy Analytics believes that ASPs [average selling prices] will hold up better than previously forecast, GaAs device manufacturers targeting this market, such as TriQuint and Avago Technologies in North America, Toshiba and Mitsubishi Electric in Japan and UMS in Europe, will need to optimize their supply relationships to maintain margins in this competitive market," Anwar concludes.

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Mobile phone sales rise 12% to 305m in Q2/2008

Sales of mobile phones neared 305m units in Q2/2008, up 11.8% on Q2/2007, according to market research firm Gartner Inc's report 'Dataquest Insight: Market Share for Mobile Devices, 2Q08'.

Sales in the mature markets of Western Europe and North America recovered slightly after a difficult start. Western Europe reached close to 42m, while North America surpassed 44m.

"The economic environment continued to negatively impact mobile phones sales in both mature and emerging markets," says Carolina Milanesi, research director for mobile devices. "Consumers in mature markets continued to favour mid-tier devices over high-end devices, while new subscribers continued to join mobile networks in emerging markets," she adds. "However, replacement sales remained weak, as consumers faced higher prices for fuel and food in addition to higher levels of inflation. Despite this, we remain positive that mobile phone sales in 2008 will reach 1.28bn units."

Japanese vendors such as Sharp, Panasonic and Kyocera have historically been the closest to the top five vendors in the rankings. However, in the past couple of years the Japanese market has become more saturated and their attempts to break into other markets have failed, weakening their role in the worldwide market. Players such as Research In Motion, Tianyu Technology and Gionee Communication of China have subsequently been filling the void.

Nokia sold 120.4m phones in Q2/2008 and widened its lead to 39.5% market share. Sales in the ultra-low-cost segment remained strong due to its distribution strategy, economies of scale and brand power. However, competition is increasing in this segment and at the high end. In July, Nokia applied strategic price cuts in its mid-tier portfolio, which put pressure on competitors such as Sony Ericsson and LG. Gartner expects Nokia to increase its market share in second-half 2008 due to its wide portfolio, but also its long-awaited touch-screen phone will be a high/mid-tier device rather than the expected high-tier device. This should help drive sales, assuming that it has the right look, specification and usability.

Samsung's sales reached 45.7m. Good inventory management pushed sales up and helped it reach a market share of 15.2% in Q2. Strong performance helped widen its lead over third-placed Motorola. Milanesi expects Samsung's sales to remain strong in second-half 2008 as new products such as the Omnia pick up momentum.

Despite its sales growing quarter-on-quarter to 30.4m, Motorola's market share dropped further from 14.5% a year ago to just 10% in Q2. Its portfolio remained uncompetitive because of its lack of 3G and 'hot' applications such as GPS and good-quality internet browsing. Gartner remains sceptical that Motorola's revamp of products such as the Ming in response to the touch-screen market frenzy is a strategy that will help boost sales.

Shipments (in millions) and market share (Gartner).

Vendor	Q2/08	Share	Q2/07	Share	Change
Nokia	120.35	39.5%	100.03	36.7%	20.3%
Samsung	46.37	15.2%	36.21	13.3%	28.1%
Motorola	30.37	10.0%	39.53	14.5%	–23.2%
LG Electronics	26.70	8.8%	18.52	6.8%	44.2%
Sony Ericsson	22.95	7.5%	24.35	8.9%	–5.7%
Others	57.97	19.0%	53.96	19.8%	7.4%
Total	**304.72**		**272.60**		**11.8%**

N.B. Includes iDEN shipments; excludes ODM to OEM shipments.

The firm risks having to lower the prices of its handsets to compete because of a lack of features.

LG's positive momentum continued in Q2, with sales of 26.7m, boosting market share year-on-year from 6.8% to 8.8%. LG's efforts to strengthen its portfolio and improve profitability have paid off. Gartner expects LG to sell most of the inventory built up in Q2 during Q3, making up for expected weaker sales into the channel.

With sales nearing 23m handsets, Sony Ericsson's market share grew slightly on Q1, but fell year-on-year from 8.9% to 7.5%, preventing it from advancing from fifth place. "Our confidence in an improved performance by Sony Ericsson weakened further as recent product announcements were disappointing, since they delivered similar current features and designs," says Milanesi. Sony Ericsson has gone from eyeing third place to fighting to regain fourth place in just a few quarters. Gartner reckons that it needs new designs and a wider feature and application offering to remain competitive.

In Q2/2008, 115m handsets were sold in Asia/Pacific, up 20.5% year-on-year. Net new cellular connections declined significantly, from more than 83m connections in Q1 to 75m in Q2, negatively impacted sales of mobile devices. "High food prices and inflation also had a negative impact on sales of replacement mobile handsets," says Anshul Gupta, principal research analyst for

mobile terminals in Mumbai, India. Sales in emerging markets bolstered overall growth, as growth in mature markets remained flat.

Sales in the Eastern Europe, Middle East and Africa region rose 18% year-on-year to 56m handsets. "The economy in several countries has slowed down and the region saw slower-than-expected replacement sales as consumers dealt with the higher cost of living," says Annette Zimmermann, senior research analyst for mobile devices in Munich, Germany. "Despite these unfavourable conditions, operators and handset vendors continue to target areas with low penetration in the Commonwealth of Independent States and West Africa," she adds.

In Japan, sales to end users fell 22.1% year-on-year to 9.4m. "This drop is twice as much as last quarter and was the result of a lack of new phone features compelling enough to drive growth," says Kenshi Tazaki, managing vice president, mobile communications research in Tokyo, Japan. Also, pricing schemes introduced at the end of 2007 that reduced subsidy levels have further weakened users' impetus to replace their handsets.

Sales in Latin America rose almost 19% year-on-year to over 38.5m. This was below expectations, due mainly to strong growth in Q1 and slightly weaker demand in Q2, generating higher levels of inventory as vendors did not fully materialize sales, says Tuong Nguyen, analyst for mobile terminals in Arlington, VA.

In North America, sales to end users rose 6.58% year-on-year to 44.1m. "Despite industry concerns over the economic downturn, handset sales were strong, up 5.3% quarter-on-quarter," says Hughes De La Vergne, principal analyst for mobile terminals research in Dallas, TX. However, new subscribers were limited, as growth continued to be dominated by replacement sales.

Sales in Western Europe rose 16% quarter-on-quarter to nearly 42m in Q2, but still fell 8.2% year-on-year. Market penetration reached 121.5% in first-half 2008, showing a strong dependence on replacement sales as a market driver. Economic conditions remained challenging. However, some vendors and operators felt this more than others, with Sony Ericsson continuing to feel the strain and Vodafone' sales being affected by delays in the availability of new devices and slower replacement sales, Milanesi adds.

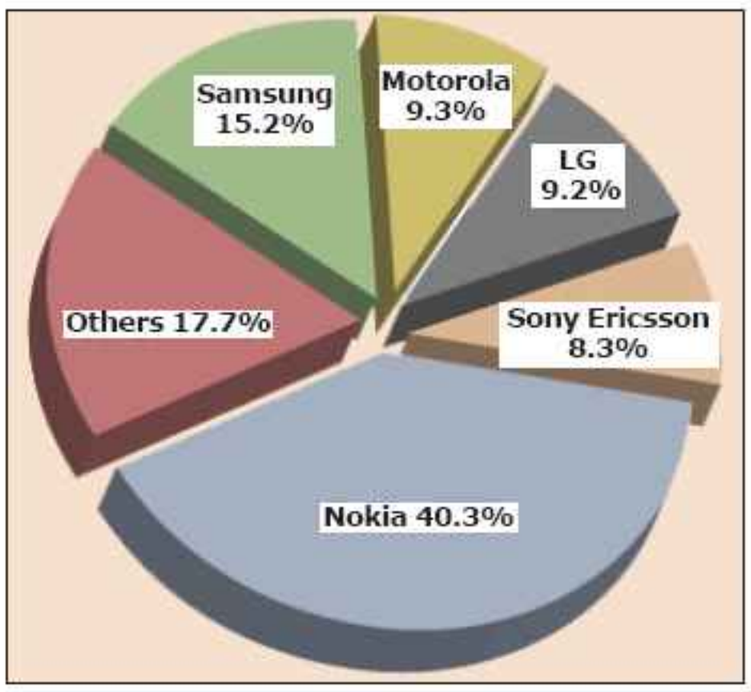
For full-year 2008, Gartner expects growth of 11% in handset unit sales, but just 9% in revenue as increased competition and a tougher economic environment hit average selling prices. "In addition, mobile phone manufacturers will be put under pressure to maintain healthy margins while they intend to further break through the emerging markets to increase sales," concludes Milanesi.

www.gartner.com

Mobile market on course for 1.3bn despite economic woes

In Q2/2008, tier-one handset vendors saw year-on-year unit shipment growth of 15–22% to an estimated 301m units, says ABI Research, reaffirming its forecast that the mobile device market will deliver 13% growth on 2007 to take 2008 annual shipments to 1.3bn units.

"If there is an economic slowdown, no one bothered to tell the mobile device buying public," says ABI's VP Jake Saunders. "Consumers in emerging markets in Asia, the Middle East, Africa and South America shrugged off inflation fears to sign up as mobile phone users. These healthy gains in net subscriber additions are stimulating replacement and upgrade sales," he adds. "In developed markets, handset purchases tended to be flat, but those consumers who did purchase dug deeper and paid out more for coveted higher-end handsets and smart-phones."



Mobile device market share Q2/2008.

In terms of market share, Nokia has passed the 40% threshold for the first time (40.3%). Samsung secured second place with 15.2%, while Motorola's 9.3% just kept ahead of LG's 9.2%, while both edged out Sony Ericsson (8.3%). LG may put Motorola into fourth place by the end of Q3/2008.

"There is admittedly turmoil in the global economy, but the mass market's fascination with getting the latest and greatest handset shows no sign of abating," notes research director Kevin Burden.

Apple's iPhone has rewritten the rulebook. Nevertheless, despite the expected successes that the tier-one handset vendors garnered in first-half 2008, Nokia's overall market share is likely to hold, as it refreshed its portfolio in the mid-tier and high-end categories and has more or less cornered the ultra-low-cost handset market.

www.abiresearch.com

RFMD's restructuring increases losses despite revenue growth

For fiscal Q1/2009 (ended 28 June), RF Micro Devices Inc of Greensboro, NC, USA has reported revenue of $240.5m, up 13.7% on $211.6m a year ago and 9% on $220.6m last quarter.

This reflects sequential growth in core front-end revenue for RFMD's Cellular Products Group (CPG) of 10% (about three times the global handset unit growth rate, and substantially better than the market seasonality), having shipped production volumes to all five leading handset OEMs and gaining market share. By air interface standard, RFMD's greatest growth was in 3G (up almost 50% year-on-year), which it expects to continue to be a growth catalyst into the future.

Cellular front-end growth came from extra content and functionality in handsets plus crisp execution on customer diversification, according to chief financial officer Dean Priddy. So, despite pockets of softness in China, RFMD took share at targeted OEMs. The growth reflects last quarter's commitment to triple business at Samsung and double business at Sony Ericsson, while LG's front-end business was also a growth driver. RFMD's strategy to sharpen its focus on cellular components is ahead of schedule, Priddy reckons.

Transceiver business was down sequentially and now represents well under 10% of total revenue. Sales of Polaris 2 to Motorola fell $22m (to less than 3% of revenue).

RFMD's Multi-Market Product Group (MPG) grew sequentially for all five product lines (Aerospace & Defense, Broadband/Consumer, Standard Products, Wireless Infrastructure and Wireless Connectivity), significantly exceeding its revised target of 20% sequential revenue growth that it provided on 3 June (and exceeding 25%).

MPG revenue growth was a significant contributor to gross margin improving from 25.2% to 30.1% (but still down on 31.5% a year ago). Compared to net income of $23.6m a year ago, net loss has grown from $17.2m to $24.1m, reflecting charges of $26.6m related to the restructuring announced on 6 May (involving a staff reduction of about 10%, all in the Wireless Systems Group including future-generation transceiver and GPS development). However, on a non-GAAP basis (excluding such charges), net income grew from $2.2m to $7.9m (up on $6.6m a year ago).

RFMD's new strategy and diversification efforts are already paying dividends, one quarter ahead of original estimates, says president & CEO Bob Bruggeworth. The results reflected new 'soft synergies' from acquiring Sirenza Microdevices Inc in November, including supply chain savings and volume buying power on component parts.

MPG is diversifying RFMD into a broader set of customers and end markets, supporting thousands of customers with a product portfolio that is expanding rapidly. MPG released 27 new products during the June quarter, and is on track to release more than 100 new products and to now exceed its goal of $250m in MPG revenue in fiscal 2009.

CPG is also experiencing increased design and bookings activity, driven by multiple customers. RFMD sees cellular order activity improving in second half of calendar 2008, and continues to model 10% global handset growth in 2008.

For the September quarter, RFMD expects sequential revenue growth in both CPG (driven by handset unit volume growth, share gains at targeted accounts, new handset launches and improved order visibility) and MPG (supported by improved order visibility across multiple markets), increasing total revenue by 8% to $250–260m.

RFMD is on track to eliminate about $75m in annual CPG product development expenses by the end of calendar 2008. "Consistent with our strategic restructuring announcement on May 6, we have eliminated all product development expenses related to wireless systems, and we believe our organization is now positioned to achieve sustainable, long-term growth and profitability," says Bruggeworth. "We have already begun to deliver the expense reductions forecast for later this year, and we are well on our way to achieving our stated goal of at least 10% non-GAAP operating income and double-digit return on invested capital (ROIC) by the December quarter," he adds.

"June financial performance and September quarterly guidance highlight the progress we have made in achieving our financial goals," says Priddy. "RFMD's sharpened focus on RF components and compound semiconductors is driving our revenue and profitability, and our expense reductions are ahead of schedule."

"GaAs usage is going to increase over the next few years," he adds. RFMD's total addressable market for RF components and compound semiconductor related products is now $8–10bn. February's acquisition of Filtronic Compound Semiconductor in Newton Aycliffe (now RFMD UK) hence gives the firm much flexibility. "It's a tremendous benefit to have that capacity reserve," he concludes.

● As part of its restructuring, RFMD had intended to sell its GPS business and engaged with potential buyers. However, it has been unable to reach an agreement, and is now pursuing licensing opportunities.

www.rfmd.com

RFMD launches triple-path cellular front-end for 3G handset platform

RFMD has captured a major design win on the upcoming 3G multimode platform of a 'leading handset original equipment manufacturer' (OEM).

RFMD secured the win with 'the industry's highest performance and most highly integrated triple-path, broadband power amplifier' (PA). Based on customer forecasts and design activity, RFMD expects volume shipments to start in Q4/2008.

RFMD's triple-path 3G PA combines three broadband (multi-band capable) power amplification paths in a single, size-reduced package: one low-band and two high-band broadband amplifiers, enabling 3G handset designers to simultaneously address any combination of the eight major WCDMA cellular frequency bands without external tuning. Also, broadband, triple-path capability enables handset designers to implement a single RF platform across all 3G band combinations, maximizing flexibility, reducing space demands and accelerating time to market.

The triple-path PA succeeds a dual-path version and implements a balanced amplifier design. This improves total radiated power (TRP) and specific absorption rate (SAR) performance, eliminating costly RF isolators and simplifying multi-band platform implementation. TRP-compliant handsets improve network efficiency, enhance network coverage and increase data throughput.

"Handset designers using our broadband 3G PA can implement a single, scalable 3G platform that services multiple WCDMA bands through simple changes in filter components," says Eric Creviston, president of RFMD's Cellular Products Group. No change to the RF layout of the phone board is necessary. "We plan to introduce additional 3G front ends with even greater functionality, higher dollar content and higher levels of integration, as future architectures incorporate duplexers, switches and other functions previously implemented on phone boards discretely."

RFMD's multi-band, broadband 3G product offerings include the RF6280 3G transmit system, which supports all major WCDMA bands and comprises a front-end power management IC optimized for the RF6281 (a dedicated single-band PA module supporting Band I) and/or RF6285 (a flexible multi-band, broadband PA module, capable of supporting Bands I, II, III, IV, V, VI, VIII, IX).

RFMD says it is capturing extra RF content as the industry continues to migrate to data-centric 3G handsets covering multiple regions, requiring multiple WCDMA frequency bands and hence more PAs, duplexers, switches and support components. In 2009, the firm expects about 50% of 3G handsets to support two or more WCDMA frequency bands.

Wilkinson replaces Paladino as chairman

After RFMD's annual shareholders meeting, Walter H. Wilkinson Jr — founder & general partner of venture capital firm Kitty Hawk Capital of Charlotte, NC (founded in 1980) and a member of RFMD's board since 1992 — was appointed chairman. He replaces Dr Albert E. Paladino, who has been a director since 1992 and chairman since August 2002, and who was re-elected as a board member.

CEO Bob Bruggeworth is grateful for Paladino's "leadership, integrity, and vision... We look forward to continuing to work with him as a director and valued advisor."

"Walter is a recognized leader with years of involvement with RFMD as an outside director," adds Paladino. "His guidance as chairman will prove invaluable as RFMD pursues opportunities ahead as a result of its recent strategic restructuring."

IN BRIEF

Programmable-gain upstream CATV amp

RFMD's new S518324-44Z programmable-gain upstream power amplifier is designed for cable applications including digital cable-ready TVs, set-top boxes and digital video recorders (DVRs) as well as DOCSIS 2.0-compliant cable modems. It enables cable operators to serve the rapidly growing consumer demand for interactive services and increased upstream data rates, RFMD says.

The device delivers best-in-class current consumption of 143mA, reducing the cable device's thermal profile and satisfying stringent OEM requirements for thermal management. It also has what RFMD claims is an industry-leading 63db dynamic range with an ultra-fine 0.5dB gain step resolution. Finally, it exceeds the DOCSIS 2.0 specification, providing cable set-top box and modem designers with sizeable headroom for improving performance over current generation solutions.

The S518324-44Z's lead customer selected it to reduce risk and speed time to market for next-generation set-top cable boxes, says Alastair Upton, general manager of RFMD's Broadband and Consumer business unit. "The S518324-44Z is implemented in an established 4mm x 4mm footprint [a thermally enhanced QFN20 package] and greatly improves on critical performance metrics of the existing generation solution," he says. "We look forward to continued design activity with this customer related to future generations of set-top boxes and other applications."

Technical features include:

- Single 3.3V supply operation;
- 5–65MHz operating range;
- low Harmonics of –60dBc (typical) at 60dBmV;
- three-wire serial interface for dynamic range control;
- EuroDOCSIS 2.0 compliant.

Anadigics cuts Q3 forecast and China fab acceleration

For Q2/2008, GaAs-based wireless and broadband communications component maker Anadigics Inc of Warren, NJ, USA reported a 13th consecutive quarter of revenue growth, to a record $80.5m (up 8.2% on last quarter's $74.4m and 49.4% on $53.9m a year ago, and above April's forecast of $77–79m).

Gross margin improved from Q1's 36.8% to 38.4%, and net income rose from $1.9m a year ago and $3.9m in Q1 to $6m.

Growth was due mainly to broadband revenue rising 35% from Q1's $23.2m to $31.2m. This more than compensated for wireless revenue of $49.3m, up 78% on $27.7m a year ago but down $1.9m (3.7%) from Q1's $51.2m.

"Q2/2008 results were driven by strong sequential revenue growth in broadband for both WiFi and CATV, including initial production shipments of our new digital tuner, FiOS and DOCSIS 3.0 products," said president & CEO Dr Bami Bastani.

Entering Q3, broadband revenue was expected to continue to offset an expected decline in wireless. Certain customers have built up inventory in critical components such as power amplifiers, lowering demand. A large Korean customer is halving inventory, while some weakness is seen among 3G handset makers in China, depressing Q3 wireless revenue by up to 10%. Anadigics expected total sales of $75–81m, up 26–36% year-on-year but barely up on Q2.

However, Bastani believed the wireless slowdown to be temporary, as design-in activity has risen (highlighting the addition of new customers and platforms such as smartphones at Research-in-Motion).

"The company's balance sheet remains strong as we continue to invest in sustaining business growth for the long-term," said chief financial officer Tom Shields.

Due to the confidence in its business fundamentals, Anadigics said that it would accelerate the build-out of its second 6" GaAs fab (which broke ground on 9 July in Kunshan, China), including doubling total investment from $49.88m to about $100m (to allow completion of building construction by October, with start-up due for Q3/2009 before ultimately doubling Anadigics' existing fab capacity).

However, just three weeks later, on 7 August, Anadigics cut back its Q3 revenue guidance by 18% to $62–65m (up just 4–9% annually and down 19–23% on Q2). Bastani said that the revision is a result of a further weakening in demand from wireless handset customers.

Due to this, as well as the weakening economy, while the firm remains committed to completing construction of its Kunshan fab by October, Anadigics has made the 'prudent' decision of delaying the additional capital investment above the $49.88m originally contemplated until it has better visibility as to when it needs the plant to become operational.

Anadigics has made the 'prudent' decision of delaying the additional capital investment

However, Bastani added that Anadigics remains optimistic about growth in the wireless 3G handset market and is confident of its ability to provide best-of-breed products.

www.anadigics.com

Anadigics' president and CEO Bastani resigns

Anadigics has announced the resignation of president and CEO Dr Bami Bastani, and the appointment of Gilles Delfassy (a director of the firm since January) as chairman of the board. Delfassy assumes CEO responsibilities until a permanent replacement for Bastani is found.

Delfassy has almost 30 years of experience in global business development and wireless technology. He led Texas Instruments' wireless terminals business unit from its inception in 1995, growing it into a multi-billion dollar operation.

Bami Bastani.

Under his guidance, TI became the leading supplier of semiconductors for wireless handsets. Previously, he managed TI's European digital signal processing operations and automotive electronics business.

"Bami has made a significant contribution to Anadigics by guiding us over the past ten years," says Anadigics' founder and vice chairman Ron Rosenzweig.

"Gilles is the ideal person to move the company forward during our CEO search," he adds. "His extensive understanding of the semiconductor industry, coupled with his knowledge of our customers and his experience in managing a business with high-volume manufacturing operations, will help ensure a smooth transition."

Gilles adds, "We will work hard to make sure we keep the confidence and trust of our customers during this transition and beyond."

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SIGMA-ALDRICH®

Skyworks grows faster-than-expected 23% year-on-year

For fiscal Q3/2008 (ended 27 June), Skyworks Solutions Inc of Woburn, MA, USA, which manufactures linear products, power amplifiers, front-end modules and radio solutions for handset and infrastructure equipment, has reported revenue of $215.2m, up 6.7% on $201.7m last quarter and 23% on $175.1m a year ago (and above the firm's guidance of $210m).

Gross margin rose from 39.8% last quarter to 40.2% (the fifth consecutive quarter of improvement). Net income has nearly doubled from $11.4m a year ago to $20.5m. Skyworks also generated $26.2m of cash flow from operations, raising the total in fiscal 2008 so far to $122m.

During fiscal Q3, Skyworks ramped energy management solutions in support of automated meter reading (AMR), advanced metering infrastructure (AMI) and ZigBee applications; supported Microsoft's Sync initiative with low power control ICs, enabling fully integrated, voice-activated in-car communications for mobile phones and digital music; captured strategic reference design wins at Qualcomm for forthcoming CDMA2000, EDGE and 3G HSDPA architectures; and powered more than ten new Samsung 3G handset models (including the first European mobile TV slider phone).

"Skyworks is delivering profitable growth driven by increasing diversification in wireless and adjacent analog markets, share gains and strong operational execution," says president and CEO David J. Aldrich. "Our unique technical breadth and manufacturing scale are strategically differentiating Skyworks and positioning us for sustainable, above-market revenue growth with improving fundamentals," he adds.

"New program launches, targeted design-win ramps and market share gains are translating into improving order visibility," says VP and chief financial officer Donald W. Palette.

For fiscal Q4/2008 (to end-September), Skyworks therefore expects revenue to rise another 4.6%, to $225m.

New program launches, targeted design-win ramps and market share gains are translating into improving order visibility

"At the same time, we plan to deliver further operational improvements in product yields, equipment efficiency and cycle times," Palette adds. "In turn, we intend to expand gross and operating margins."

● Skyworks surpasses 2 billion power amplifier modules

Skyworks says that it has shipped more than 2bn power amplifier (PA) modules since product inception near the turn of the decade.

The company claims to be an architectural pioneer of PA and complete front-end modules (FEM), and uniquely supplies to each of the world's top five handset original equipment manufacturers (OEMs) and two leading smartphone makers. Skyworks says it has also developed design partnerships with all of the industry's leading base-band suppliers and, most recently, has captured key sockets on Qualcomm and MediaTek reference designs.

"We are even more excited about the design-win traction of our next-generation of multi-mode Intera front-end modules," says Liam K. Griffin, senior VP of sales & marketing. "Given the strength of our product pipeline, Skyworks is benefiting from the trend towards highly integrated, multi-band FEMs for 3G, EDGE, LTE and WLAN applications," he adds. "New product ramps of our content-rich Intera portfolio, coupled with our diversification initiatives, are positioning Skyworks to outpace our addressable markets this quarter."

www.skyworksinc.com

RF subsystem for femtocell base-stations and cellular repeaters

Skyworks has launched what it claims is the industry's first highly integrated RF subsystem for GSM, GPRS and EDGE femtocell base-stations and cellular repeaters. The new RF subsystem supports femtocell base-station and cellular repeaters in the GSM850, EGSM900, DCS1800 and PCS1900 bands.

"Skyworks' new and innovative RF subsystem solves a variety of real-world issues that manufacturers face daily," says Stan Swearingen, vice president and general manager of Linear Products. "Ultimately, we're enabling them to reap considerable benefits by reducing space, expense, and time-to-market."

According to the firm, the dual-chip RF subsystem provides excellent linearity, blocker performance, dynamic range, and output power required by cellular operators, carriers and equipment manufacturers deploying femtocell base stations and cellular repeaters.

Skyworks adds that the market research firm In-Stat reckons that worldwide femtocell subscriptions (installed devices) will grow to 40 million by 2011 and represent a market opportunity of over $4bn.

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Kopin's III-V revenues compensate for drop in sales for displays

For Q2/2008, Kopin Corp of Taunton, MA, USA, which makes III-V HBT epiwafers and CyberDisplay LCDs, has cut net loss from $3.2m a year ago to $1.7m on revenue of $25.8m (up 18% on $21.9m a year ago but down 12% on last quarter).

However, of this total, III-V revenue has grown slightly to $12.2m from $12.1m last quarter (compensating for the drop in CyberDisplay revenues), as well as being up by 9% on $11.2m a year ago.

"Our strategic investments to expand manufacturing capacity, enhance manufacturing capability and improve yield produced measurable results in the second quarter, as our gross margin nearly doubled from the same period in 2007," says president & CEO Dr John C.C. Fan. Improved gross margin and increased revenue in first-half 2008 also reflect Kopin's increased focus on higher-value product applications across the CyberDisplay and III-V sectors and reduced participation in commodity consumer electronic applications, he adds.

"In our III-V product category, while revenue grew modestly in the second quarter, the long-term trends influencing this business are positive," Fan said. A recent study from the research firm Strategy Analytics noted that the market for GaAs devices grew 17% in 2007, and that the overall metrics for the market remain strong. "As one of the world's largest merchant suppliers of GaAs-based transistors, Kopin is in an ideal position to capitalize as this segment continues to grow," he believes.

"Our integrated circuit partners are introducing new semiconductor solutions that address the performance demands of today's wireless communications environment, and our HBTs and related technologies are playing an integral role in powering those products," Fan continues. During the quarter, Kopin announced the extension of its HBT purchase and supply agreement with its long-time partner Skyworks Solutions (which manufactures linear products, power amplifiers, front-end modules and radio solutions). Kopin will supply Skyworks with all of its 4-inch wafer requirements and the vast majority of its 6-inch requirements through July 2010. The alliance not only covers a broad spectrum of III-V technologies, but also ensures that Skyworks and Kopin continue to work collaboratively to improve manufacturing efficiencies and lower production costs.

"Based on our strong top-line performance through the first two quarters of 2008, and our momentum heading into the second half of the year, we are on pace to achieve, and perhaps exceed, our full-year revenue guidance of $105–115m [up 7–17% on 2007's $98.1m]," Fan reckons. "We expect our III-V category to remain a consistently strong performer."

Kopin's recent expansion of III-V 6-inch wafer manufacturing capacity and capability should enable it to continue to enhance efficiency, cut cost and introduce higher-performance HBT structures, he believes.

www.kopin.com

Skyworks expands Cedar Rapids Design Center

Skyworks Solutions Inc of Woburn, MA, USA is expanding its design center in Cedar Rapids, IA by 50% from 28,548ft^2, adding a further 14,366ft^2. After receiving formal approval and breaking ground in late August, occupation is planned for March.

"Our Cedar Rapids Design team is expanding to meet the growing demands of the dynamic wireless semiconductor industry," said James Young, VP of engineering. "We have an established track record of innovation and successful product development in Cedar Rapids," Young adds.

The facility houses design engineering, as well as layout and testing for a variety of products. From employing six staff on opening in 1998, the site currently has about 100 staff. Skyworks says that its experience in attracting and retaining quality staff in Cedar Rapids was a factor in deciding to expand the local operation. Skyworks will employ an extra 30-plus design engineers, product engineers, layout designers, managers and technicians over the next 3 years. Assistance comes via tax credits from the City of Cedar Rapids and the State of Iowa, including $1m in R&D tax credits over 5 years. Also, Kirkwood Community College will provide training (allowing about $318,000 per year for new staff).

"The expansion of Skyworks' design center further demonstrates that the Cedar Rapids/Iowa City Technology Corridor continues to be at the forefront of innovative technologies," says Mark Seckman, president of Priority One (the Cedar Rapids Area Chamber of Commerce's economic development division).

"Priority One will aggressively assist Skyworks through our workforce initiatives to attract the highly skilled personnel needed to fulfill the technologically advanced positions created by this expansion," Seckman adds.

www.skyworksinc.com
www.priority1.com

TriQuint's Q2 growth slowed by delayed product ramp

For Q2/2008, GaAs-based RF component maker and foundry services provider TriQuint Semiconductor Inc of Hillsboro, OR, USA has reported revenue of $127m.

Excluding $5.6m from WJ Communications of San Jose, CA (acquired on 23 May), revenue was $121.4m. This is up 6.7% on $113.8m a year ago and up 9% on Q1's $111.1m, driven by strong growth in wireless LAN and 3G handset products (in particular, shipping a high volume of its Tritium III next-generation 3G power amplifier modules). However, in early July, TriQuint had lowered its guidance from $130–135m (up 17–22% from Q1/2008) to 'about $120m' (up 8%) due to 'slower-than-expected new product ramps and shipment timing issues'.

On a non-GAAP basis, gross margin has risen from 35.5% last quarter to 37%, driven by improving product yields and the higher margins of the WJ products. Excluding a $1.6m loss from WJ, net income was $5m, up from $4.5m last quarter and $1.4m a year ago.

Cash, cash equivalents and short-term investments fell by $121m to $98.3m. However, this was due to the WJ purchase, substantial capacity investments, and growth in inventory in preparation for rapid growth in the coming quarter.

Multi-band and multi-mode applications are accelerating RF demand

"TriQuint is on track for achieving our product development and design-win targets for the year, with each of our markets generating strong order activity and a strong book-to-bill ratio of 1.29," says president and CEO Ralph Quinsey. During Q2/2008, TriQuint won designs at 15 handset customers with its new Hadron PA module.

"Multi-band and multi-mode applications [e.g. 3G handsets and Wi-Fi, particularly 802.11n] are accelerating RF demand, with two to four times the content for TriQuint products in new applications, creating growth opportunities," he adds.

In Q2/2008, TriQuint began to ramp new products for 3G and 802.11n. While the profile of the ramp was slightly delayed compared to original expectations, Quinsey expects second-half 2008 to be a period of solid growth for TriQuint.

In particular, for Q3/2008, TriQuint is 95% booked and expects revenue of $155–170m (up 22–34% on Q2).

www.triquint.com

TriQuint wins Northrop's Strategic Supplier and Innovation awards

At its Supply Chain Management (SCM) and Mission Assurance (MA) 2008 Supplier Conference, NGES (Northrop Grumman Electronic Systems) recognized TriQuint with one of only two 'Innovation' awards presented this year. The award was for development of bulk acoustic wave (BAW) S-band tuned coupled resonator filter (TCRF) modules, designed and manufactured at TriQuint's facility in Bend, OR.

TriQuint also received a Strategic Supplier Award for support provided by its design and manufacturing center in Richardson, TX. The firm was recognized for its products and service. "TriQuint will continue serving this important customer with the latest RF power and acoustic filter devices," says Dr Gailon Brehm, Military Products marketing director.

TriQuint was among only 61 NGES suppliers nominated to receive awards. Fewer than 2% of suppliers are nominated each year, with less than 1% receiving awards. TriQuint was one of 32 firms recognized, and the only one to win two awards.

www.es.northropgrumman.com

(L to R, in front of phased array radar antenna components for AWACS aircraft): TriQuint's VP of Military Products Tom Cordner, Northrop Grumman program manager Jim Martz, and Military Passive Devices general manager Steve Mahon; Northrop Grumman's John Gornto, subcontract administrator Howard Flynn and MMIC Design Engineering manager Paul Laux; sales rep Jeff Fields of New Era Sales; TriQuint's director of product marketing Dr Gailon Brehm; and Northrop Grumman's strategic supplier manager Vivian Chen.

X-band high-power amplifiers in surface-mount packages

StratEdge of San Diego, CA, USA, which designs and produces packages for microwave, millimeter-wave and high-speed digital devices, is offering packaged high-power amplifier MMICs (fabricated by a US GaAs foundry) for 8–12GHz (X-band) applications, suited to point-to-point radios and base-stations.

The new SMX 580448 family covers the full X-band range in three separate bands. Part numbers 560141 for 7–8.5GHz, 560142 for 10.5–12GHz, and 560134 for 9–10.5GHz applications, which provides 37dBm output power and 40% power added efficiency (PAE) for biasing of 7V, 1.4A (with typical gain of 18dB).

StratEdge says that the SMX 580448 is a ceramic surface-mount package with excellent thermal properties that provides good electrical transition performance for die in the X-band range. The package has a copper composite base that enhances thermal dissipation. Though sealed with epoxy and a liquid crystal polymer lid, it can pass fine and gross leak hermeticity testing per MIL-STD-883. The assembly process, including eutectic and epoxy component attach, gold wire bonding, lid seal, lead trim, electrical test, labeling, and delivery preparation, is performed at StratEdge.

"We packaged the MMICs and tested them in a custom fixture to verify electrical performance," says Casey Krawiec, VP of North American sales. "Providing a good heatsink is critical for optimal performance," Krawiec adds. "As an aid to our customers, we'll provide a CAD file with our recommended LAND pattern for their boards."

The SMX 580448 family of packaged devices is lead-free and RoHS compliant. Other versions with fully hermetic soldered metal lids are available.

www.stratedge.com

Mimix appoints senior vice president of sales & marketing

Mimix Broadband Inc of Houston, TX, USA, which supplies GaAs semiconductors from DC to 50GHz for microwave and millimeter-wave applications, has appointed Greg Baker as senior VP of sales & marketing, responsible for managing the sales cycle, acquiring new customers, expanding existing customer relationships, and launching new products.

Baker has more than 20 years experience in RF and microwave component design, marketing, and sales. Baker was most recently VP of international sales at Sirenza Microdevices, where he served in various technical and managerial roles for over ten years (including senior director of marketing, VP of engineering, and VP and general manager of the Standard Products Unit) after being one of the firm's first employees.

Previously, Baker worked in RF design and technical management positions for several electronics companies, including Fujitsu Microelectronics, ITT (GTC), Hughes-Delco, and Motorola.

Mimix's Greg Baker.

Baker has a BSEE from Texas A&M University, an MSEE from Georgia Tech, and an MBA from the University of Phoenix.

"Greg has extensive experience in the RF semiconductor industry with a clear understanding of sales channels, strategic marketing, and product positioning," says CEO Rick Montgomery.

"I look forward to working with Mimix's solid customer base, introducing new customers to Mimix products, and launching even more new products into Mimix's already-diverse portfolio," says Baker.

www.mimixbroadband.com

Mimix launches 10–16GHz receiver

Mimix Broadband has made available engineering samples of a 10–16GHz GaAs pHEMT SMT-packaged receiver that integrates a low-noise amplifier (LNA), image reject mixer and LO buffer amplifier within a fully molded 4mm x 4mm QFN package.

The XR1015-QH has a noise figure of 2.5dB and a conversion gain of 12dB. The image reject mixer eliminates the need for a bandpass filter after the LNA to remove thermal noise at the image frequency. The device is suited to point-to-point radio, LMDS, SatCom and VSAT applications, says Mimix.

The XR1015-QH offers an integrated solution for multiple receive applications and allows a complete SMT receiver to be built with just the one component," says product manager Paul Beasly.

"The device is unique due to its small standard package size, inclusion of high levels of on-chip ESD protection structures, and combination of low noise figure, high conversion gain and linearity across the band," he claims.

Mimix has also introduced a QFN-packaged GaAs MMIC linear power amplifier (PA) with +39dBm OIP3 and 26dB small-signal gain.

The XP1035-QH PA covers the 5.9–9.5GHz frequency range and includes an integrated temperature-compensated on-chip power detector. The PA comes in a fully molded 4mm x 4mm QFN package and includes on-chip ESD protection structures and DC bypass capacitors to ease implementation and volume assembly. The device is suited to point-to-point radio, LMDS, SatCom and VSAT.

Hittite rebounds slightly, but next quarter to be flat

For Q2/2008, Hittite Microwave Corp of Chelmsford, MA, USA, which designs and supplies RF, microwave and millimeter-wave ICs, modules and subsystems, has reported sales of $45m, up 4% on Q1's $43.3m and 19.6% on $37.6m a year ago. Of total revenue, 40% came from the USA and 60% from outside the USA (up from 58% last quarter).

"Increased international sales allowed us to achieve our objectives," says chairman and CEO Stephen Daly. "Our product development team continued to execute, and during the quarter we introduced our eighteenth product line, a new phase lock loop (PLL) product line, which will serve all of our target end markets," he adds. "In total, we introduced 26 new products during the quarter across all of our product lines, in line with our plan for the year."

After falling from 71% over the last year, gross margin has rebounded from 70.1% last quarter to 70.8%. Likewise, net income has rebounded slightly to $13.5m from $13m last quarter, as well as being up on $12.2m a year ago. Total cash has risen again during the quarter, by $5m to $186.2m.

Increased international sales allowed us to achieve our objectives

For Q3/2008, Hittite expects revenue to be flat at $44.5–45.5m and net income to be $13.1–13.5m.

Hittite launches first integrated RMS and peak-to-average power detector SMT IC

Hittite has introduced what it claims is the industry's first integrated RMS power detector that is capable of simultaneously measuring the instantaneous (RF envelope) power and the true RMS power of any RF input signal from 100MHz to 3.9GHz.

The HMC614LP4E provides a 'true RMS' representation of any RF/IF input signal and is suited to wide-bandwidth, wide-dynamic-range applications requiring repeatable power measurement over temperature, especially where the RF/IF waveshape and crest factor change with time. The device uses a new circuit architecture that enables simultaneous measurement of peak power and average power. A peak-to-average output signal provides a direct read of the signal crest factor.

The HMC614LP4E provides a differential input sensing range of 72dB, to ±1dB detection accuracy up to 3.9GHz with what is claimed to be excellent crest factor immunity and temperature stability. The device also exhibits less than ±0.1dB measurement deviation at +12dB crest factor, and less than ±0.5dB measurement deviation over the full operating temperature range.

Operating from a +5V supply, the device is specified for operation over the –40°C to +85°C temperature range, and is supplied in a compact 4mm x 4mm leadless QFN package.

SMT product samples and evaluation PC boards for all SMT-packaged products are available.

www.hittite.com

SiGe PA for mobile WiMAX

SiGe Semiconductor has expanded its series of power amplifiers (PA) and RF front-end modules by sampling the SE7262L, a 2.5GHz high-power amplifier targeted for the mobile WiMAX market that exceeds the spectral mask requirements outlined in IEEE 802.16e and WiMAX Forum specifications.

The firm says the device optimizes performance and delivers high stability over the full temperature range (–40°C to +85°C), enabling support of broadband wireless multimedia services in products for mobile computing applications without compromising battery life. Suitable applications include USB accessories, PC cards, and embedded cards for laptop computers.

The new PA delivers more than 20% efficiency at +25.5dBm output power while operating at 3.3V, the highest performance available while meeting worldwide spectral mask requirements, the firm claims. High output power and linearity, exceptional efficiency and unequalled temperature stability enable systems that require low current for increased battery life and provide reliable wireless link performance, it adds.

"The SE7262L will allow our customers to support mobile WiMAX capability with the highest performance but without degradation of battery life," says Sanjiv Shah, director, product marketing WiMAX and embedded products.

Mobile WiMAX PAs often need an increase in supply voltage to achieve higher output power, requiring additional voltage regulation and raising power consumption and cost to the system bill of materials. The SE7262L eliminates this.

The SE7262L offers high integration, with an on-chip power detector, step attenuator, and harmonic filter in a 4mm x 4mm x 0.9mm package, boosting system performance and cutting overall footprint and bill of materials cost, it is claimed.

www.sige.com

Avago files for $400m IPO

Singapore-registered Avago Technologies Ltd has filed a registration statement with the US Securities and Exchange Commission (SEC) for an initial public offering (IPO) of its common stock worth up to $400m. Avago has applied for quotation of its ordinary shares on NASDAQ under the symbol 'AVGO'.

Avago designs and manufactures analog IC and optical devices for industrial and automotive electronics, wired infrastructure, wireless communications, and consumer and computing peripherals (focusing on III-V based products). Its portfolio of about 7000 products includes RFICs, LED displays, color sensors, optical and laser mouse sensors, and optical telecoms transmitter and receiver modules as well as transceivers. Customers include Cisco, HP, IBM, LG Electronics, Logitech, Motorola, Samsung and Sony Ericsson Mobile Communications.

The business began as part of Hewlett-Packard in 1961. In 1999 it became the semiconductor product group of spin-off Agilent Technologies. In 2005 the group was acquired for $2.66bn in a leveraged buy-out by private-equity firms Kohlberg Kravis Roberts and Co (KKR) and Silver Lake Partners, which own a combined stake of 80.9%. Other shareholders include Seletar Investments (10.6%) and Geyser Investment (7.1%). The firm was subsequently renamed Avago.

To reduce debt related to the buy-out, Avago has sold off several units, including its printer ASIC chip division to Marvell Technology Group Ltd in 2006 for $275m and its storage chip division to PMC-Sierra Inc in 2007 for $425m.

For continuing operations, Avago reported a loss of $227m on sales of $1.4bn for fiscal 2006 (to end-October) and a loss of $159m on sales of $1.53bn for fiscal 2007. Sales from products targeted at the wireless communications market grew as Avago focused on changing its product mix towards more proprietary products, says the firm. Revenue from products targeted at the industrial and automotive electronics market experienced moderate growth, driven by fiber optics in the automotive market offset by weaker optocoupler and LED sales.

For fiscal first-half 2008 (to 4 May), Avago made a profit of $21m on sales of $813m (versus just $10m on revenue of $755m a year ago). But long-term debt remains $710m.

Besides improving its bottom line, Avago says it is moving towards a fab-lite model. The firm already outsources most manufacturing for certain types of chip (i.e. silicon), using external wafer foundries including Singapore's Chartered Semiconductor Manufacturing Ltd and Taiwan Semiconductor Manufacturing Company Ltd (TSMC) and third-party contract manufacturers for assembly & test, including Amertron Inc, Amkor Technology, and the Hana Microelectronics Public Company Ltd group of firms. However, Avago owns manufacturing facilities, in particular in Fort Collins, CO, USA and Singapore for III-V based LEDs and RFICs. The firm also has two design facilities in the USA (California and Colorado), three in Europe (Germany, Slovakia and Italy), and four in Asia (Singapore, South Korea and Malaysia).

● Avago has appointed Douglas R. Bettinger as senior VP and chief financial officer.

"I am confident of his ability to contribute substantially as we enter the next stage of growth," says president & CEO Hock Tan.

Bettinger was most recently VP of Finance and Corporate Controller at Xilinx Inc. Previously, he was CFO at privately held 24/7 Customer, where he established and managed worldwide financial and operations functions. Bettinger also spent 12 years at Intel, where he served in senior finance and manufacturing operations positions, including Corporate Planning and Reporting Controller, and was instrumental in implementing Sarbanes-Oxley regulations and managed external reporting duties. He also served as Malaysia Site Operations Controller, overseeing financial reporting for Intel's biggest assembly & test plant.

www.avagotech.com

SMT-packaged driver amps for 18-33GHz frequencies

Avago has launched a highly efficient, linear power amplifier for the 18–33GHz frequency range that provides high dynamic range and low current consumption.

The AMMC/P-6333 MMIC is fabricated using Avago's unique 0.25μm enhancement-mode pHEMT technology, and delivers a high gain of 20dB and high power (P1dB) of 23dBm, coupled with excellent input and output return losses, the firm claims. The devices are built to allow design engineers to meet driver amplifier needs for broad-band frequencies while eliminating the need for negative voltage requirements for better RF performance.

With 50Ω matching and third-order intercept point of 30dBm, the new amplifier is easy to use with a single positive voltage supply and DC power of 5V bias at 220mA.

Available either as bare die or in a 5mm x 5mm surface-mount package (making it easy to store, manage and integrate for a wide range of applications), the device targets wireless communication infrastructure, including point-to-point radios, VSAT and fiber to the home.

Pricing for the AMMC-6333 and AMMP-6333 is $13.20 and $19.80, respectively, in 100–999 volumes.

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IQE extends range of InGaAs SWIR detector products

Epiwafer and substrate foundry IQE plc of Cardiff, Wales, UK has extended its range of InGaAs short-wavelength infrared (SWIR) detector products to include 3" extended-wavelength epitaxial materials. Generic epitaxial structures are available with spectral response up to 2.2, 2.4 and 2.6μm in 2" and 3" wafer diameters.

The 2.6μm design demonstrated responsivity >1A/W at 1.6–2.5μm, and a peak of 1.2A/W at 2.3μm. Such a spectral response was achieved using a highly strained InGaAs absorbing layer deposited on a proprietary graded buffer layer, grown by MOCVD on InP substrates.

Custom designs and variations of the generic structures can be accommodated, from initial product development through to volume production.

"We are experiencing increased market demand for extended-wavelength products produced on larger wafer diameters," says IQE Europe's InP product manager Dr Wynne Jones. "This increased demand is largely driven by the need for large-area arrays incorporated into low-light and night-vision systems, machine vision, spectroscopy, instrumentation and image recognition," he adds.

Also, IQE's base epitaxial product offering will be complemented by an in-reactor Zn diffusion service, which the firm says has demonstrated superior device performance over closed ampoule diffusion process, particularly for larger-area wafers up to 4" InP.

"There will be further enhancements of the product range to include Zn diffusion of extended-wavelength detectors which follows on from the successful launch of Zn-diffused InP PIN diodes and avalanche photodiodes (APDs), leading to a wide range of PIN detector products available in wafer sizes up to 4" in diameter," adds Jones.

www.iqep.com

IQE Silicon adds two new processes, funded by Welsh Assembly

The IQE Silicon operation in Cardiff has added two major new technologies, developed with funding assistance from the Welsh Assembly Government (in line with their SMART development programs).

The new processes are aimed at improving the speed and power consumption of silicon chips by using materials such as strained silicon and sapphire for future generations of high-speed applications, including the RF wireless and broadband markets. The radiation-hard attributes of the materials also lend themselves to aerospace applications. Future developments could also see the products being used as advanced microcontrollers for industrial, consumer and automotive devices.

"One of these new processes has already been fully qualified with a key customer and will go into production immediately," says IQE Silicon's operations manager Moz Fisher.

"The second process requires some significant product re-engineering by the customer, which will extend the qualification period but is expected to be in volume production in the next two years," he adds.

AmpTech launches GaAs and InP foundry services

AmpTech Inc has announced availability of commercial contract-manufacturing foundry services at its fabrication facility in Milpitas, CA, USA. The firm offers gallium arsenide and indium phosphide processes targeted at RFIC and optoelectronics applications.

In May 2007, AmpTech bought the 4-inch GaAs wafer fabrication plant of WJ Communications Inc of San Jose, CA and entered into a technology license and foundry agreement with WJ (which in November 2006 had announced plans to go fabless).

AmpTech has since production-qualified processes for GaAs MESFETs and InGaP HBTs. The MESFET process offers linear gain of more than 85% of the device operating range. The HBT process is characterized by breakdown voltages in excess of 25V. In addition, process modules have been adapted to manufacture optical devices, including GaAs and InP PIN photodetectors.

"AmpTech is committed to providing foundry services, and can offer significant advantages in development time, production turn-around, and security of supply for key components in our target markets," says president and CEO Ray Milano. The manufacturing line (including a 15,000ft^2 cleanroom) is fully operational, and has shipped more than 1.5 million tested parts to customers since starting commercial production in fourth-quarter 2007.

"AmpTech provides front-end circuit design support, wafer processing, back-end characterization, RF and DC production testing, and die separation," says Craig Farley, director of foundry services. "Our production line includes redundancy in all key equipment to ensure a smooth and predictable material flow, and we offer fast-turnaround options for prototyping," he adds. "We achieve high yields on both our HBT and MESFET processes, and offer our customers the choice of known good wafers, or known good die."

www.amptechdesign.com

High-speed wireless sustains growth

For first-half 2008, epiwafer foundry and substrate maker IQE plc of Cardiff, Wales, UK has reported revenue of £30.2m, up 27% on first-half 2007's £23.7m.

This increase is due to the wireless sector growing 36% from £17.3m to £23.6m (outstripping growth in handset sales because of increasing GaAs content in 3G, smartphone and other high-speed wireless systems). In contrast, sales for electronics applications are flat on £1.25m, while sales for optoelectronics applications have grown only slightly from £5.1m to £5.3m.

The strong sales reflects IQE's continuing focus on high-growth, high-volume markets, particularly wireless communications, where 3G and smartphone technology is rapidly being adopted to meet growing demand for advanced mobile features such as e-mail, internet browsing and video streaming, says chief executive Dr Drew Nelson. According to market research firm Gartner, 3G sales currently represent about 12% of the handset market but should grow by 52% in 2008.

"The relentless drive for higher-performance mobile devices and lower power consumption is only made possible through the increasing use of GaAs-based products," Nelson adds.

Due to high operational gearing, earnings before interest, tax, depreciation and amortisation (EBITDA) grew by 135% from £1.5m in H1/2007 to £3.6m.

Operating profit rose from just £64,000 in first-half 2007 to £1.6m in first-half 2008. However, this was reduced to just £11,000 by an exceptional cost of almost £1.6m from relocating IQE's plant in Singapore (formerly MBE Technology) to larger facilities (to be completed in second-half 2008).

IQE says it is confident that its markets will be resilient to the global economic slowdown, with trading in Q3/2008 continuing be in line with expectations as demand for GaAs-based products is increasing across a range of technologies, including communications, office, solar and solid-state lighting.

Nelson says that IQE is in the process of bringing to market a range of new technologies, with its product roadmap and strategy continuing to be driven by four market dynamics with high-growth, high-volume prospects:

Demand for GaAs-based products is increasing across a range of technologies, including communications, office, solar and solid-state lighting

- high-speed mobile communications (including 3G, WiFi, WiMAX, WiBro, GPS and other wireless technologies);
- semiconductor lasers (for HD-DVD, laser mouse, laser projection, gaming, and office and industrial applications);
- high-efficiency solar cells and ultra-high-brightness LEDs for solid-state lighting;
- higher-speed, more powerful microprocessors and ultra-high-density memories (driving demand for new materials solutions based on silicon substrates, including compound semiconductors incorporated directly onto silicon substrates).

"The board remains confident that the strong markets for our products as well as our high operational gearing will ensure that we remain on course to deliver strong growth in sales and profits for the full year," says Nelson.

www.iqep.com

IN BRIEF

IQE launches MEMS epitaxy services

IQE has added a range of epitaxy services for enhanced MEMS capabilities, with its silicon facility offering engineered substrates for emerging MEMS markets in wafer sizes up to 200mm.

The new foundry services are suited to technologies based on either SOI or bulk silicon wafers. IQE claims that its single-wafer reactors offer excellent resistivity and thickness uniformity with tight control of doping and other critical film parameters. Abrupt transitions are possible between differently doped layers and films are free from crystal originating particles and other types of bulk silicon defects, says the firm.

The MEMS epi services include: thick virtual SiGe substrates, thin superlattice structures, SiGe etch-stop layers, and SiGe epi for applications such as IR sensors. The MEMS services also include what IQE claims is the industry's largest range of materials capabilities, with multi-layer Si, SiGe and Ge epitaxy. Different doping levels and species within each layer can also be accommodated, as can epitaxial layers on SOI.

IQE says that engineered substrates enable flexibility in the manufacture of MEMS devices, allowing the design of products free of the limitations imposed by standard bulk silicon substrates.

"Substrates that are tuned to customers' specific requirements provide the ideal foundation for next-generation MEMS products and avoids the need for compromising design processes to fit the substrates' properties," says Alistair Hoy, sales manager for IQE Silicon Products Division. "Key players are turning to engineered substrates to facilitate greater flexibility and control over their design and manufacturing processes," he adds.

Raytheon wins $1m GaN & MEMS contract for active electronically scanned lens array

As part of its Active Electronically Scanned Lens Array (AESLA) program, the US Office of Naval Research has awarded Raytheon's Integrated Defense Systems (IDS) business of Tewksbury, MA, USA a $1m base contract that could be worth more than $14m (if all four options are exercised) after developing an application for a pair of emerging technologies that, the firm claims, dramatically increases radar sensitivity while improving affordability. Joe Smolko of Raytheon IDS' advanced technology group is program manager for the AESLA program.

One of the technologies is a high-power transmit-receive radar module enabled by gallium nitride monolithic microwave integrated circuits (MMICs).

The other is a low-loss, reliable phase shifter employing RF micro-electro-mechanical systems (MEMS) technology.

Together, they combine to form a new, low-cost AESLA architecture that, the firm claims, can provide up to 10 times higher radar sensitivity at 40% lower cost compared to the existing technology that is used in radar transmitters and receivers.

"By exploiting RF MEMS, we have created an AESLA architecture that enables next-generation radars to achieve the sensitivity required to engage increasingly challenging targets," says Mark Russell, Raytheon's VP of engineering, technology and mission assurance. "We can deliver this considerably increased capability at a significantly lower cost in comparison to current architectures," he claims.

Development will take place at Raytheon's Advanced Product Center in Dallas, TX as well as at Raytheon's RF Components in Andover, MA.

www.raytheon.com/businesses/rids

International Rectifier launches GaN-on-Si power device technology

Power semiconductor device maker International Rectifier Corp (IR) of El Segundo, CA, USA says that, after five years of R&D, it has developed a power device technology platform based on proprietary GaN-on-silicon epitaxy that can provide improvements in key application-specific figures of merit of up to a factor of ten compared to state-of-the-art silicon-based technology platforms. This could boost performance and cut energy consumption in computing, communications, appliances and automotive applications.

IR says that, by deploying its 60-year heritage in power conversion, the portfolio of system solution products and related IP extends beyond leading-edge discrete power devices in applications such as AC-DC power conversion, DC-DC power conversion, motor drives, lighting, high density audio and automotive systems.

High-throughput 150mm GaN-on-Si epi, together with device fabrication processes that are compatible with IR's silicon manufacturing facilities, offers a commercially viable platform for GaN-based power devices.

"We fully anticipate the potential impact of this new device technology platform on the power conversion market to be at least as large as the introduction of the power HEXFET by IR some 30 years ago," says president & CEO Oleg Khaykin.

IR debuted the new GaNpowerIR power device technology platform at events in September including the Digital Power Forum '08 in San Francisco, the Embedded Power Conference 2008 in San Jose and the International Workshop on Power Supply on A Chip in Cork, Ireland.

Prototypes of GaN-based products will be available to leading OEM customers at November's Electronica trade show in Munich, Germany, for initial product releases in late 2009.

"Early adopters will be those market segments and applications that will take full advantage of the revolutionary capability of transforming the value realization of the key features of power density, power conversion efficiency and cost," says Khaykin.

www.irf.com

Nitronex awarded Phase II STTR grant to enhance GaN-on-Si HEMTs

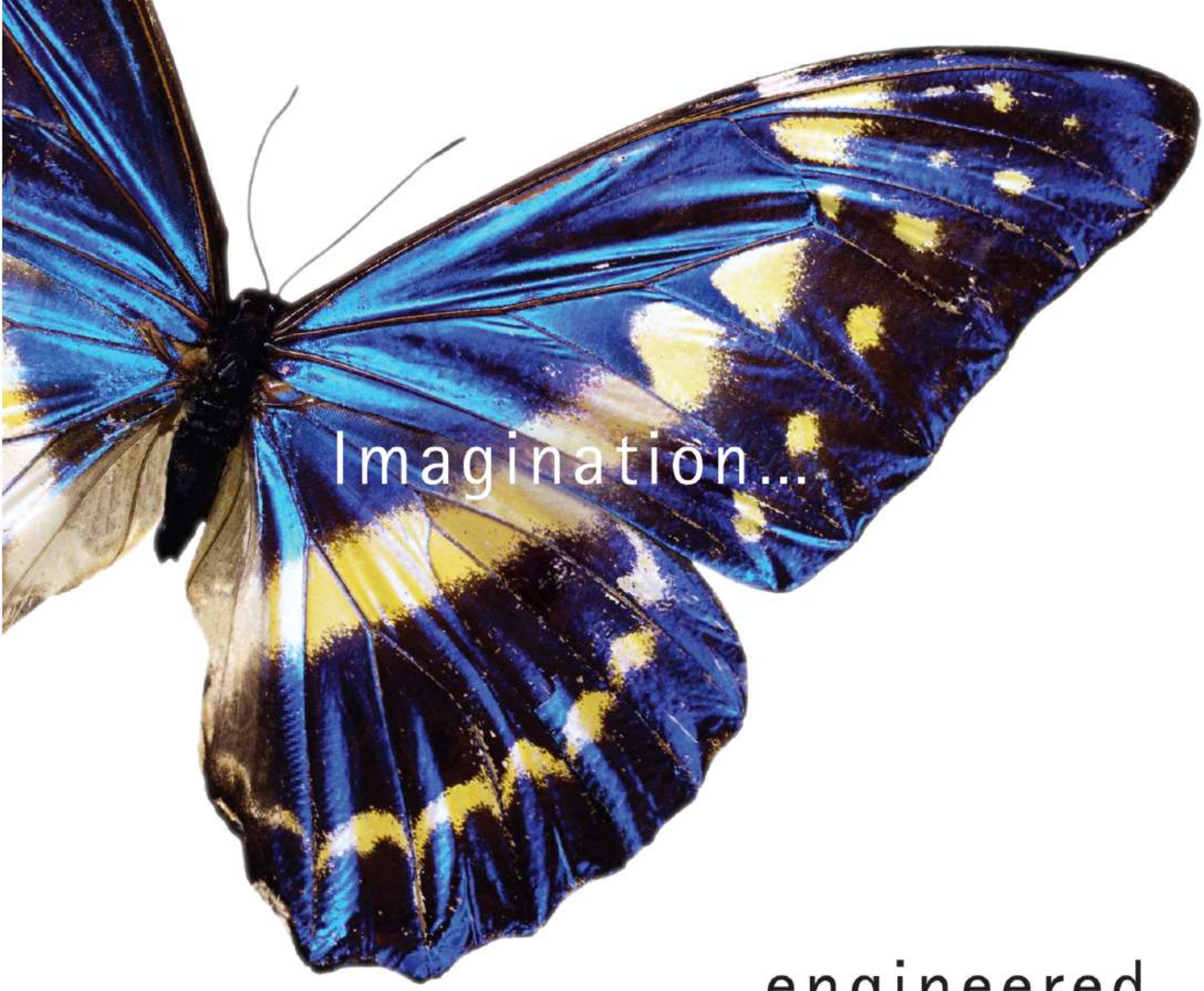
Nitronex of Durham, NC, USA, which manufactures RF power transistors for the commercial wireless infrastructure, broadband and military markets, has received Phase II STTR (small business technology transfer) funding from the US Department of Defense (DoD) to further develop its GaN-on-silicon technology for military and aerospace applications.

The two-year Phase II STTR program began in first-quarter 2008. The primary objective is to deliver high-power X-band GaN monolithic microwave integrated circuits (MMICs) that address ballistic missile defense radar needs of the US Missile Defense Agency (MDA).

Nitronex is working with the MDA to advance its GaN-on-Si HEMT and MMIC manufacturing infrastructure and to broaden the operating frequency range of its RF power discrete devices and MMICs for both commercial and military applications, says the firm's director of advanced technology, Edwin Piner.

"The program's high-power X-band GaN-on-Si MMICs will enable X-band radar with increased performance capability, reduced size, weight and power consumption (SWAP) while simultaneously leveraging the inherent affordability and reliability of our technology," Piner adds.

www.nitronex.com



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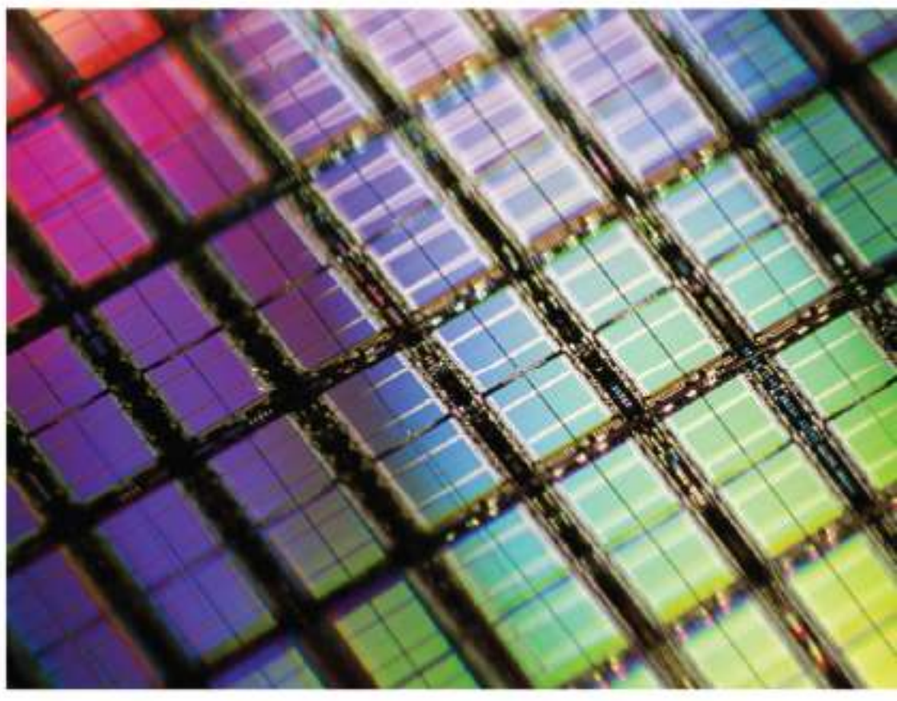

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Fox signs third SiC patent license

The Fox Group Inc of Montréal, Canada has entered into a patent license agreement with the Wide Bandgap Materials (WBG) group of II-VI Inc's compound semiconductor business, which manufactures single-crystal silicon carbide (SiC) substrates for the solid-state lighting, wireless infrastructure, RF electronics and power switching industries at its plant in Pine Brook, NJ, USA.

This is the third non-exclusive license agreement that Fox has signed in as many months for its SiC-related patents, showing that the industry is taking note of its strong patents, the firm claims. "II-VI is a well-known market leader in the silicon carbide substrate market," says president & CEO Barney O'Meara.

"Fox Group's key patents are for SiC with low defect density, which is especially desirable for LEDs, RF devices, and high-power semiconductors," says O'Meara. "Non-exclusive licenses are still available to companies in the SiC industry," he adds. "Since Fox Group is not making SiC wafers or devices, we are happy to have our patents being utilized by our licensees."

www.thefoxgroupinc.com
www.iiviwbg.com

GeneSiC selected by US Navy for Phase I and II SBIR awards

GeneSiC Semiconductor Inc of Dulles, VA, USA has been selected by the US Navy for two Small Business Innovation Research (SBIR) awards.

Founded by Dr Ranbir Singh as president in 2004, privately held firm GeneSiC develops high-temperature, high-power, and ultra-high-voltage silicon carbide (SiC) devices for rad-hard and sensor applications, including high-temperature rectifiers, field-effect transistors (FETs), bipolar devices as well as particle and photonic detectors.

The latest SBIR awards will allow GeneSiC to develop high-voltage SiC devices that are critical for enabling the integration of high-power radars, directed energy weapons (DEW) and ship propulsion systems with the modern on-board power sources.

The projects awarded to GeneSiC are as follows:

- Prompted by the success of GeneSiC's previous Phase I SBIR project, the US Navy's Naval Surface Warfare Center has selected GeneSiC's Phase II SBIR proposal for award negotiations. The project is focused on developing multi-kV SiC devices for power conditioning and power distribution systems using legacy and modern ship bus infrastructure.
- The Navy's Space and Naval Warfare Systems Command (SPAWAR) has completed formalities on another Phase I SBIR award. The project is focused on the design and fabrication of novel SiC devices for high-frequency, high-power radar applications.

"Power devices targeted in these programs will allow megawatt-level power to be handled with digital precision," says GeneSiC's president Dr Ranbir Singh.

"This technology has the potential to revolutionize critical commercial and military hardware, not yet possible due to the limitations of contemporary silicon-based technologies," he adds.

"These device development programs can also significantly improve the efficiency levels in power inverters used to integrate wind and solar energy systems with the power grid."

GeneSiC says that it is also continuing to rapidly enhance the equipment and personnel infrastructure at its facility in Dulles, including hiring personnel experienced in compound semiconductor device fabrication, semiconductor testing and detector designs.

www.genesicsemi.com

SemiSouth promotes Roberts from COO to CEO

SemiSouth Laboratories Inc of Austin, TX, USA, which designs and manufactures SiC-based discrete electronic power devices and epiwafers, has appointed Kenney Roberts (chief operating officer since joining the firm in February) as president and CEO.

"Kenney has helped drive significant advances in SemiSouth's operational performance," says board member Don Mundie.

Roberts began his career at Mostek Corp in 1974, commercializing next-generation DRAM chips. He joined AMD in 1983 and led its transition from NMOS to CMOS. In 1988, he became the director of engineering for AMD's Embedded Processor Division, ramping next-generation processors to high-volume production. In 1993, he joined Crystal Semiconductor as VP of operations, later becoming senior VP of worldwide operations for parent company Cirrus Logic, which became the fastest fabless firm to achieve $1bn in revenue.

Kenney Roberts.

Roberts has since guided venture-backed startups, as president & CEO of Colorado MicroDisplay, COO of Layer N Networks, and president & CEO of TeraVicta Technologies.

Founder and chief technology officer Jeff Casady says Roberts has a mix of business, engineering and operating skills, with expertise of commercializing new products proven over a wide array of technologies. "As SemiSouth penetrates the solar, switched-mode power supply and hybrid electric vehicle markets, Kenney's leadership will be invaluable."

www.semisouth.com

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AXT still grows despite dip in 6-inch GaAs shipments

For Q2/2008, substrate maker AXT of Fremont, CA, USA has reported revenue of $19.9m, up 46% on $13.6m a year ago but up only slightly on last quarter's $19.6m.

In particular, GaAs substrate sales were $13.1m, up on $9.3m a year ago but down slightly from $13.7m last quarter (including 6" revenue dropping from $5.9m to $5.5m). This was due mainly to three issues: a US customer closing operations (leading to an abrupt halt of shipments); a major Asian customer shutting operations for two weeks for routine annual maintenance; and a parametric issue with 6" substrates for the latter customer due to a change in their application. AXT says that it is working closely with the customer to reach a solution, and shipments of 6" substrates are resuming in Q3/2008.

Indium phosphide (InP) substrate revenue was $500,000, up slightly from $478,000 last quarter but down on $660,000 a year ago. Germanium (Ge) substrate revenue was $1.4m, flat on last quarter but up from $402,000 a year ago. Raw materials sales were $4.9m, up from $3.3m a year ago and $4m last quarter as more orders were shipped to customers to avoid transportation restrictions prior to the start of the Beijing Olympics.

Operating income has risen from $1.4m a year ago and $2m in Q1/2008 to $2.3m.

"Our business continued to perform well during the second quarter, with growth at many key customers across our product lines," says chairman & CEO Phil Yin. "We were able to meet our total quarterly revenue expectations [$19.7–20m] and exceed our operating income target despite the issues relating to two customers of our GaAs substrates."

However, due to the impact of the foreign exchange losses and a loss on the sale of investment, net income was $0.7m, down on $2m last quarter and $1.2m a year ago.

For third-quarter 2008, AXT expects revenue to rise slightly to $20.1–20.5m due to growth in its GaAs substrate business (particularly in 6", as demand remains strong) as well as continued gains in market share across the firm's product lines. "Germanium substrates are performing very well in qualifications [for triple-junction solar cell applications], and we expect to see further growth in this area as we ramp new and existing customers in the second half of the year," says Yin.

www.axt.com

sp3 engages APA as sales representative for CVD diamond thermal management products

sp3 Diamond Technologies Inc of Santa Clara, CA, USA, a supplier of diamond film products, equipment and services, has engaged Advanced Packaging Associates Inc (APA) as a sales representative, responsible for increasing sales of sp3's chemical vapor deposition (CVD) diamond products for thermal management applications. APA will target prospective customers in California, Arizona and New Mexico.

APA will be responsible mainly for marketing sp3's DiaTherm heat spreaders and diamond wafer coating services. The firm claims that its DiaTherm thick-film CVD diamond heat spreaders exhibit high thermal diffusivity and conductivity, making them suitable as mounting structures for laser diodes, laser diode arrays, LEDs and high-power semiconductor devices (including RF). It says that its wafer coating services deliver a proven diamond CVD process to reach an ever-widening range of thermal management and diamond-on-silicon applications that can be deposited on wafers up to 300mm.

"Electronics manufacturers continue to explore new materials that offer higher performance at lower costs, across a wide spectrum of applications," explains Dwain Aidala, president and COO of sp3 Diamond Technologies. "We have proven that our CVD diamond is an ideal material to address thermal management issues in particular, while being extremely cost-effective to implement," he adds. "Given that diamond's benefits have been demonstrated, we are now at a juncture as an organization that speaks to increasing our sales outreach. APA is an ideal partner for us, thanks to their background and industry knowledge, and we have tasked them with actively marketing our products and increasing their adoption in electronics manufacturing."

APA specializes in microelectronic design and assembly, high-density interconnect (ceramic, organic), thermal management and component fabrication. The main responsibility for representing sp3's thermal management portfolio falls to APA's president Stu Weinshanker, whose professional experience includes sales, marketing, engineering and operations management positions.

"We expect that sp3's DiaTherm heat spreaders and CVD diamond wafer coating services, with the significant performance improvements they deliver, will be of great interest to the electronics manufacturing and packaging markets," says Weinshanker.

www.sp3diamondtech.com

www.advpkgassoc.com

IN BRIEF

Riber slashes operating losses

Following its initial statement of first-half 2008 financial results in July, MBE equipment maker Riber of Bezons, France has confirmed H1/2008 sales of €5.2m. This is up 117% on €2.4m a year ago due to the sale and delivery of four research machines (compared to none in H1/2007) as well as service and accessory sales up 50%.

Gross profit in first-half 2008 was €0.9m (17% of sales), up from H1/2007's €0.2m (8%) due to a more favorable product mix, combined with enhanced productivity and a sharp decrease in warranty costs.

As a result of cost-cutting measures taken in 2007 (which were stepped up at the start of 2008), operating expenses have been cut by €0.6m to €2.9m, and operating loss has been cut from €3.3m to €2m and net loss from €3m to €2.3m.

Cash and cash equivalents have risen from €2.5m at the end of 2007 to €3.9m, due mainly to the collection of Q4/2007 sales, says Riber.

Riber says that the numerous ongoing sales negotiations for machines to be delivered before the end of 2008 are continuing to materialize. Since July, orders for two production machines and one research machine (for a Russian laboratory) have been confirmed. In addition, with the development of component and service sales, order backlog at the end of July exceeded €8.8m. Hence, Riber has reiterated its full-year 2008 revenue forecast of €18m (up slightly from €17m in 2007, but still down on 2006's €20.1m). The firm adds that it anticipates a net profit for second-half 2008.

www.riber.com

Riber buys OIPT's MBE business

Oxford Instruments plc says that the molecular beam epitaxy (MBE) business of Oxford Instruments Plasma Technology Ltd (OIPT) of Yatton, UK has been sold to MBE equipment and component maker Riber SA of Bezons, France for €450,000 plus a cash earn-out of up to €400,000 payable over three years against spares sales. Riber manufactures MBE equipment as well as effusion cells and RF sources.

Apart from MBE, OIPT provides process tools and processes based on plasma-enhanced deposition and etch, ion-beam deposition and etch, and atomic layer deposition (ALD). The firm says that it has an aggressive product development plan to enhance its existing product lines and expand into new markets, as well as a growing portfolio of new products in development. In April OIPT acquired Technologies and Devices International Inc (TDI) of Maryland, MD, USA, which manufactures nitride materials using patented hydride vapour phase epitaxy (HVPE) systems (which OIPT aims to produce). It adds that in the last 12 months it has seen significant growth in a number of markets, and the transfer of the MBE business will allow it to focus more sharply on these areas (consistent with the firm's strategy to double the size of the business and increase return on sales by ten percentage points). OIPT says it is confident that Riber will continue to offer the level of support required by its MBE customers. The transfer of the MBE business will take place in advance of OIPT's relocation to a new facility.

Riber says that, in line with its strategy to develop sales of service and accessories for MBE equipment, the acquisition will reinforce its share of the MBE market in Europe, North America and Asia. The firm will hence be able to service about 75% of the worldwide installed base, with its number of MBE systems increasing from about 500 to 800. In recent years, the average turnover of the OIPT MBE business was above €1.2m. This will strengthen Riber's after-sale business, which has increased by about 35% in 2008 versus 2007 as a result of internal growth and the recent merger with Addon, which specializes in MBE reactor components.

OIPT gains BS OHSAS 18001 certification for commitment to heath and safety

Etch and deposition equipment maker Oxford Instruments Plasma Technology (OIPT) of Yatton, UK has been awarded BS OHSAS 18001 certification for its commitment to heath and safety.

Certification officially recognises OIPT as meeting the standards set by BS OHSAS 18001:2007, which defines the requirements for establishing, implementing and operating an Occupational Health and Safety Management System.

Sean Stephenson, OIPT's health, safety and facilities manager said: "Achieving this standard has recognised OIPT's continual dedication to the safety and welfare of its employees and customers, and to providing a safer working environment. It also shows the commitment of our facilities management team and all employees involved in improving our workplace."

www.oxford-instruments.com

Source Materials

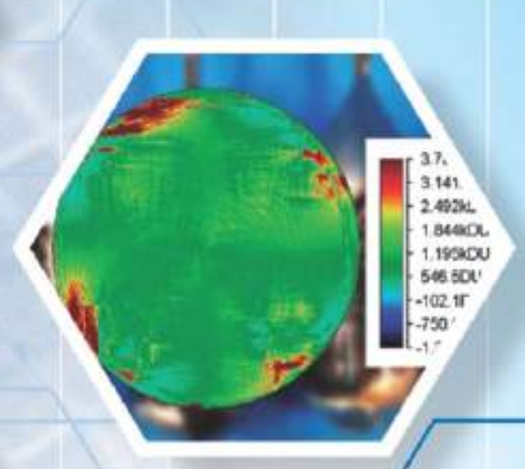
LPE

VPE

InAs

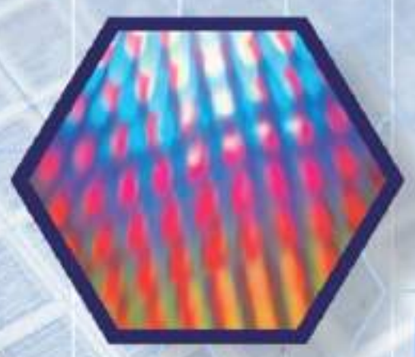
VCSEL

InSb



MOCVD

PIN



GaAs

APD

Polycrystal

Solar Cell

InP

HBT

Hall Sensor

MBE

GaSb

LED

HEMT

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IN BRIEF

Steamers for wet thermal oxidation

RASIRC of San Diego, CA, USA has sold multiple steamers for wet thermal oxidation of vertical-cavity surface-emitting lasers (VCSELs).

The systems were bought by major manufacturers in the USA and Asia for installation in development labs. The steamers improve yield in the making of the oxide aperture in VCSELs (critical for laser performance). Yield is determined by the film's uniformity, growth rate and contamination sensitivity (improved by using the steamer since it eliminates the oxygen carrier gas).

The steamer combines — in a single system — a clean steam generator (converting de-ionized water into high-flow, ultra-high-purity water vapor) and a steam purification assembly (purifying clean steam to UHP steam by selective removal of dissolved gases, metals and particulates to below levels of detection).

The system provides an alternative to bubblers and vaporizers by eliminating the need for a nitrogen or argon carrier gas (which can cause furnace uniformity challenges). Only RASIRC steamer technology can separate oxygen from the steam before entering the furnace, claims the firm.

"VCSEL yield is directly related to the precision of the oxide aperture structure," says founder & president Jeffrey Spiegelman. "This hinges on the ability to deliver oxygen-free steam and to tightly control the temperature and water vapor uniformity, so the choice of the water vapor delivery system is critical," he adds. "The RASIRC steamer provides 100%-pure water vapor in a controlled fashion. This is an economical, safe, and very effective method for adding water for wet thermal oxidation," he concludes.

www.rasirc.com

STS & Sumitomo Precision Products form SPP Global Business Services

Surface Technology Systems plc (STS) of Newport, Wales, UK and Sumitomo Precision Products Co Ltd (SPP), which provide plasma process technologies for electronic device and micro-electromechanical system (MEMS) manufacturing, have formed SPP Global Business Services (SGBS), responsible for all sales, customer support and marketing activities for both SPP and STS globally.

The firms say that the formation of SGBS is a key step in them joining forces to deliver enhanced customer support globally. "Since SPP re-acquired STS in November 2007, both companies have been working together to provide a stronger, more competitive organization with increased flexibility and manufacturing capacity," says SGBS director Dr David Haynes. "The new SGBS organization integrates personnel from both STS and SPP, providing a consistent, high standard of customer interaction worldwide," he adds.

"Both companies have been actively working together to align key areas within the business, including R&D, process engineering and manufacturing, providing our customers with the full economic benefit of our technologies as quickly as possible," says Susumu Kaminaga, president of SPP and chairman of STS.

www.stsystems.com

Lam opens Taiwan training center

With support from the Taiwan Government, etch and wafer-cleaning equipment maker Lam Research Corp of Fremont, CA, USA opened an Advanced Global Training Center in Hsinchu. Aiming to advance the technical capabilities and competitiveness of Taiwan's local supply chain, training programs should help users speed the ramp to production on new Lam process tools and enhance the productivity of existing systems.

Lam says that, to facilitate training, the new facility is near to core centers of semiconductor technology development and manufacturing. Courses will be taught in both English and the local language.

To enable both 200 and 300mm hands-on training, the 3600ft^2 facility is equipped with 2300 and Alliance-based systems. Additional equipment will be installed as demand for training grows. Process and analysis courses are designed to train customers on proven procedures known to improve the productivity of Lam equipment. Training is being conducted both by locally based Lam personnel and visiting instructors from Fremont.

Localized training not only saves customers the time and expense of travel, but also facilitates more comprehensive training, says Daniel Liao, group VP, Asia Pacific. "This is a significant benefit that is realized in the faster resolution of process and equipment issues and fewer escalations for supplier support. When customers better understand their process equipment, they can achieve the high productivity for which our equipment is designed," he adds. "This new training center will enhance support to customers in all regions, in particular, in the expanding Asia Pacific market."

- Lam's board has authorized the repurchase of up to $250m of common stock, either from the public market or in private purchases.

The program reflects confidence of both the management and board in Lam's long-term growth prospects, says president & CEO Steve Newberry. "A stock buyback is an effective use of our available capital at this time, and provides the potential for increased returns to our shareholders over the long term."

www.lamresearch.com

Tegal's sales hit by project postponements and cancellations

For its fiscal Q1/2009 (to end-June), plasma etch and deposition system maker Tegal Corp of Petaluma, CA, USA has reported sales of $4.7m, down on $7.4m last quarter.

Gross margin of 49.2% is down slightly from 50.6% last quarter. Operating loss was $1m, compared to income of $0.8m. Cash reserves have fallen by $1.1m to $18.2m.

"Our results for this quarter were below our expectations, as several projects in which we were engaged were either postponed or cancelled," says president & CEO Thomas Mika. "The current environment in semiconductor capital equipment is challenging: more so than any other time since the beginning of the decade."

Nevertheless, during the quarter Tegal shipped an advanced etch system to SVTC Technologies of San Jose, CA, USA, which operates a process development foundry for the rapidly growing novel memory and transistor market along with the MEMS/MOEMS, photovoltaics, biotechnology, image sensors and high-voltage markets. As part of the order, Tegal is also working with SVTC on process recipe development for these applications.

"The shipment of an advanced 6500 etch system to SVTC was a big plus for the quarter," says Mika. "It is a high-visibility installation, and we have already generated several sales leads from SVTC development customers." Also, Tegal is completing its Compact 360NLD system for shipment later this month. "The official launch of the product at Semicon West in mid-July was a great success," he reckons.

"While we expect the environment to remain challenging in the near future, we have a strong cash position and believe we will sustain or improve our market position."

www.tegal.com

Tegal acquires AMMS' DRIE & PECVD lines

Plasma etch and deposition system maker Tegal Corp of Petaluma, CA, USA has acquired from Alcatel Micro Machining Systems (AMMS) and parent company Alcatel-Lucent their deep reactive ion etch (DRIE) and plasma-enhanced chemical vapor deposition (PECVD) products and the related intellectual property, directed at advanced 3D wafer-level packaging applications.

Tegal paid $1m in cash and issued 1,044,386 shares of Tegal common stock (worth just under $4m at the current share price of $3.80).

AMMS president Gilbert Bellini has been appointed to Tegal's board of directors to ensure the smooth transition of the AMMS business to Tegal in the near-term and to help guide Tegal into the rapidly expanding markets for 3D wafer-level packaging applications.

"These products, along with our current etch and deposition technologies, will form the basis for a comprehensive strategy to aggressively pursue a large, high-growth market in MEMS [micro-electro-mechanical systems] and semiconductor device manufacturing," says chairman, president & CEO Thomas Mika.

AMMS' installed base of DRIE tools in use by MEMS and integrated device manufacturers will continue to be supported. Tegal will continue the development of the AMMS DRIE product line, including integration of the AMMS process modules on its recently introduced Compact bridge platform and the completion of a 300mm process chamber. Tegal is also assuming responsibility for AMMS' joint development programs.

www.alcatelmicromachining.com

IN BRIEF

GPT ships purifiers to Taiwan's Epileds and Super Nova

Johnson Matthey Gas Purification Technology (GPT) group of West Chester, PA, USA, which designs and manufactures bulk and point-of-use gas purifiers, has supplied a PSH-40 hydrogen purifier (capable of flowing 40Nm^3/hr) to Epileds Technologies Inc of Tainan Science-Based Industrial Park, Taiwan for the manufacture high-brightness blue LED chips.

This is the second bulk hydrogen purifier that Epileds has bought from Johnson Matthey (following a GPT-20 hydrogen purifier, capable of flowing 15Nm^3/hr, in late 2006).

Epileds is a joint venture formed in May 2006 between dynamic random access memory (DRAM) chip maker ProMOS Technologies and process equipment maker Hermes-Epitek, both of Taiwan, to manufacture blue LED chips.

Johnson Matthey Gas Purification Technology says that it has also supplied a PSH-30 hydrogen purifier (capable of flowing 30Nm^3/hr) to Super Nova Optoelectronics Corp (which was established in 2002 in the Ping Cheng Industrial Park, Taiwan) for manufacturing GaN-based high-brightness blue, green and blue/green LED chips.

Super Nova says that it aims to launch products exceeding 6mW of blue light and white light.

Johnson Matthey's Taiwanese sales & service agent Pionics Technology handled the sale.

Johnson Matthey adds that its bulk hydrogen purifiers are capable of providing 99.9999999%-pure hydrogen for wafer fabrication.

www.epileds.com.tw
www.supernovaopto.com
www.pureguard.net

Aixtron orders dip 15% in Q2, but backlog continues to rise

Despite a further weakening of the dollar over first-half 2008 and the current macro-economic downturn, for Q2/2008 deposition equipment maker Aixtron AG of Aachen, Germany reported revenue of €65.6m, up 4.8% on €62.6m in Q1/2008 and up 45% on €45.2m a year ago.

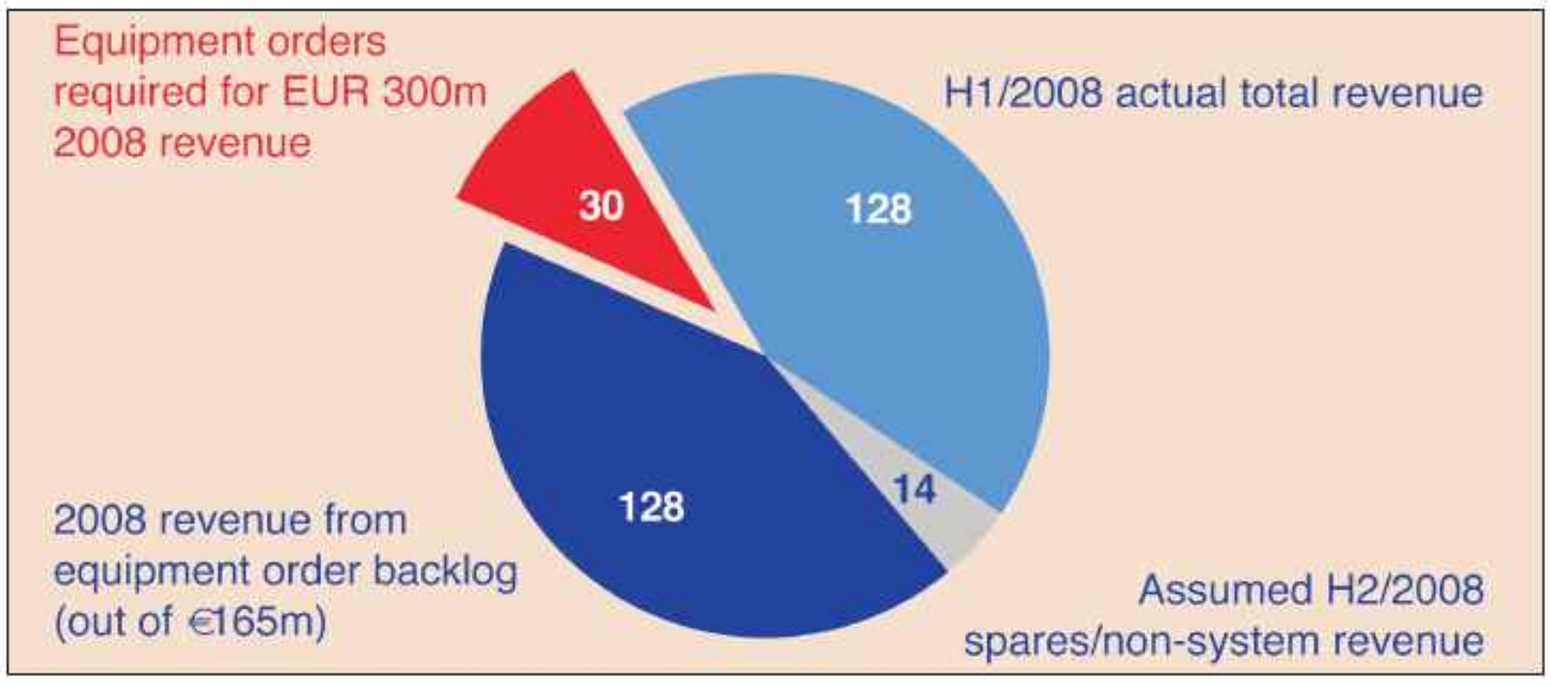
This is largely due to sales of compound semiconductor equipment (mainly for LED production) growing 46% from €71.8m (66% of revenue) in first-half 2007 to €104.9m (82%) in first-half 2008. Conversely, due to suppressed capital spending of flash memory and DRAM production customers, silicon deposition equipment shrank 58% from €24.1m (22% of revenue) to just €10m (8%).

In particular, in first-half 2008 the latest generation of high-capacity, higher-margin common platform compound semiconductor MOCVD systems rose to about 70% of total revenue (and 91% of orders in Q2), boosted by long-term orders from LED makers such as Taiwan's Epistar and Korea's Samsung, especially for emerging LED-backlighting applications. Correspondingly, 87% of total revenue came from Asia, and just 8% from the USA and 5% from Europe. This has helped to offset the negative effect of the weakening US dollar, with gross margin holding at 39% through both Q1 and Q2.

In Q1, operating profit (EBIT) almost tripled to €8.9m from €3.2m last year. Net profit was up €7.4m, almost double €3.8m a year ago.

Q2 order intake was €72.5m, up 44% on €50.3m a year ago but down 15% on last quarter's €85.5m.

Silicon deposition equipment orders fell 63% from €22.7m in first-half 2007 (25% of total orders) to just €8.4m (just 5%) in first-half 2008. Nevertheless, in second-half 2008, Aixtron will launch new system technology aimed at both the memory and logic markets.



Breakdown of Aixtron's 2008 revenue guidance (in millions of Euros).

Compound semiconductor equipment orders have more than doubled from €68.1m in first-half 2007 (75% of orders) to €149.6m (95%) in first-half 2008. In particular, Aixtron says it received orders from new large customers from adjacent sectors, interested in participating in the growth potential of the LED market. Some silicon semiconductor manufacturers — in order to pursue a horizontal diversification strategy — have expressed interest in investing in LED equipment. Meanwhile, several Taiwanese LCD manufacturers have recently announced their aim to vertically integrate by ordering MOCVD systems. Aixtron also cites LED-backlit laptops being sold by Toshiba, Fujitsu, Sony and Apple (and a six-fold rise in sales of LED backlit laptops in 2008) as a reason for LED production tools comprising 83% of Aixtron's orders in first-half 2008 (up from 65% a year ago).

Some silicon semiconductor manufacturers — in order to pursue a horizontal diversification strategy — have expressed interest in investing in LED equipment

Despite the drop in orders in Q2/2008, backlog still rose by €7.8m to €165.1m (with compound semiconductors 98% of total backlog and silicon just 2%, compared to 92% and 8% a year ago). Of this backlog, nearly 80% (€128m) is due for delivery by the end of 2008. Added to the €128.2m of revenue from first-half 2008, plus $14m in spares/non-system revenue expected in second-half 2008, this makes about €270m.

The continued revenue growth in compound semiconductor equipment and strong order backlog therefore supports the management's confidence in confirming its previous guidance (given in mid-March) for full-year 2008 sales of €270–300m (up 26–40% on 2007's €214.8m). So, compared to the €270m above in revenue and bookings, only a further €30m in orders for delivery in 2008 is needed to reach the upper target of €300m.

"We remain very positive about our medium- and long-term outlook, despite the short-term challenges the whole semiconductor industry faces [from the current macroeconomic downturn]," says president & CEO Paul Hyland. "This strength will allow us to continue to perform in the current challenging market environment," he adds.

www.aixtron.com

Taiwan's LED makers expand capacity

In the last quarter, deposition equipment maker Aixtron of Aachen, Germany received orders for MOCVD reactors from several LED makers in Taiwan and mainland China, both those expanding their production capacity to meet burgeoning demand as well as those entering LED manufacturing.

Walsin Lihwa enters LED market

Walsin Lihwa Corp of Taipei, Taiwan (which makes wires and cables, including fiber optics) ordered a Close Coupled Showerhead (CCS) CRIUS reactor in 31x2" wafer configuration (for delivery in Q3/2008).

Aixtron's new MOCVD customer has ordered the system to kick off its plan to become a large-scale manufacturer of ultra-high-brightness (UHB) GaN-based LED products. The multi-wafer reactor forms the basis of Walsin's plans to enter the lighting products business.

Since it was founded in 1966 as Pacific Electric & Wire Co Ltd, Walsin Lihwa has become a leading optical cables and wire company and expanded internationally. It merged with Lihwa Electric Wire and Cable Corp in 1969, when the name changed to Walsin Lihwa Electric Wire and Cable Corp. The firm went public in 1972 and is listed on the Taiwan Stock Exchange (being renamed again in 1992 as Walsin Lihwa Corp). In 1987 it entered the high-tech sector by investing in Winbond Electronics Corp and Wha-yo Electronic Materials Corp (although its core business remains cable, wire and steel manufacturing).

Forepi expands production

Formosa Epitaxy (Forepi) Inc of Taoyuan, Taiwan ordered four CRIUS reactors in 31x2" wafer configuration to expand its GaN-based ultra-high-brightness (UHB) LED production. This follows quick transfer of Forepi's MOCVD process to its first CRIUS systems in 2007.

Forepi has since ordered a further six CRIUS systems. "We are now adding capacity to meet the huge increase in market demand," said president Dr Fen Ren Chien. "This technology has become one of the main platforms for our large-scale high-end LED production," he adds.

HPO orders reactor to develop own blue-green UHB-LED epi

High Power Opto Inc (HPO) of Taichung, Taiwan (part of EOI Group, which includes Excellence Optoelectronics Inc of Hsinchu) ordered an AIX 2800G4 HT system for volume production of UHB GaN-based LEDs. The 42x2"-wafer system will be installed in Q1/2009.

After receiving an AIX 2600G3 Planetary Reactor last year, HPO was already producing among the brightest commercially available UHB AlGaInP red LEDs, claims chairman K.H. Huang (70lm/W @350mA, corresponding to a wall-plug efficiency of 25% at a dominant wavelength of 622nm).

HPO says that the new 2800G4 reactor will form the basis of its planned transition from buying GaN epiwafers to realizing its own GaN MOCVD process for its existing in-house device fabrication.

Century Epitech buys reactors

Also in Q2/2008, but in mainland China, Aixtron delivered an order to Century Epitech Corp of Shenzhen Guangming Technology Zone for three AIX 2600G3 MOCVD tools (one in 24x2"-wafer configuration; two in 49x2"-wafer configuration) as well as an AIX 2800G4 HT tool (in 42x2"-wafer configuration). Century Epitech says it will use the high-capacity reactors to expand its production of high-brightness power LEDs.

www.walsin.com
www.forepi.com.tw
www.eoi.com.tw
www.cnepi.com/en

IN BRIEF

Semi-Photonics begins transition to 4" GaN with AIX 2800G4 HT system

In Q2/2008, Semi-Photonics Co Ltd (a subsidiary of SemiLEDs Corp of Boise, ID, USA, which has operations in Hsinchu, Taiwan) ordered an Aixtron AIX 2800G4 HT production MOCVD system in 11x4-inch wafer configuration, for delivery by the end of 2008.

SemiLEDs manufactures LEDs for lighting applications including display, signage, communication, automotive and general lighting.

The system will begin the transition from 2-inch to higher-productivity 4-inch wafers for SemiLEDs' new 4-inch UHB GaN-based LED line.

"We are making a key transition in our production platform, and Aixtron will once again be playing a crucial role in ensuring a smooth transition," says SemiLEDs' president Dr Chuong Tran. "Achieving the best yields for the high-quantum-efficiency epitaxial structures based on proprietary vertical high-power MvpLED GaN LED technology has been realized with our existing Aixtron Planetary Reactor systems," Tran adds.

Using a copper alloy base, SemiLEDs has developed and commercialized Metal Vertical Photon (MvpLED) technology. The firm claims that, due to the metal alloy that is used and the unique device structure, its LEDs have superior electrical and thermal conductivity, delivering higher brightness, efficiency and better heat transfer.

"We expect the new 4-inch production platform to bring a dramatic increase in our LED manufacturing capability and productivity," concludes Tran.

www.semiphotonics.com
www.aixtron.com

Veeco exceeds Q2 bookings, revenues & earnings guidance

For Q2/2008, Veeco Instruments Inc of Plainview, NY, USA has reported results ahead of its guidance for bookings, revenues and earnings.

Revenue was $114.4m, up 16% on $98.8m on a year ago and 12% on $102.3m last quarter (and ahead of guidance of $102–$110m). In particular, for Veeco's largest segment (comprising 39% of total revenues), revenue for LED & Solar process equipment (i.e. MOCVD and MBE epitaxial deposition systems) was $45.1m. This is up 61% on $28m a year ago (due to strong end-user demand and expanding applications for high-brightness LEDs, with acceptances received for the K465 MOCVD system from LED-making customers). However, LED & Solar process equipment were up only 7% sequentially on $42.1m last quarter. Inventory rose by $9.9m to $115m, mainly in LED & solar process equipment after the delay of several system shipments due to LED customer facilities not being ready.

Overall net income was $4.2m, versus a $2.6m net loss a year ago, due to higher revenue from customer pull-ins combined with the benefit of cost cutting and containment activities over the past year.

Bookings were $136.5m, up 21% on $112.5m a year ago (and the most in two years), and far ahead of guidance of $110–118m. This boosted order backlog by $32m to $211m (including $8.7m from the acquisition of Mill Lane Engineering).

In particular, LED & Solar bookings were $52.1m, up 43% on a year ago and 35% sequentially (as expected, now that Veeco's latest-generation MOCVD reactors are gaining traction at key LED makers). The firm says that customers are making significant technology and capacity investments. Veeco has received multi-unit orders from five LED makers in Taiwan and China (including several first-time clients). Nearly $20m of the MOCVD orders are due to ship in 2009 (almost all secured by customer deposits and bank guarantees, as customers want to solidify their position in Veeco's manufacturing slot plan).

In addition, "Veeco is beginning to build a meaningful solar process equipment business," says CEO John R. Peeler. "MOCVD and MBE are seeing market pull for III–V concentrator and thin-film solar applications from both research institutes and commercial companies," he adds. Veeco has also announced that, during the second quarter, it received a significant multi-unit order for TurboDisc K-475 As/P MOCVD systems from Boeing firm Spectrolab Inc of Sylmar, CA to support its manufacturing capacity expansion for III-V concentrator photovoltaic (CPV) cells.

For third-quarter 2008, Veeco forecasts revenues of $113–118m (including $2–3m from Mill Lane), as well as bookings of $113–118m (with some normal seasonality). "While we start the third quarter with a strong pipeline of prospects, particularly in our LED and Solar business, we are providing cautious guidance, given our very strong bookings level in the second quarter, historically slow customer buying patterns during the summer months, and the challenging overall economic environment," says Peeler.

"At the mid-point of the year, even with the backdrop of difficult overall economic conditions, Veeco is achieving results ahead of our original expectations," comments Peeler. "We remain on track to significantly improve Veeco's performance on both the top and bottom line in 2008," he adds. The firm forecasts full-year revenue of $450–455m (up 12–13% on 2007's $402.5m), including $165–170m for the LED and Solar sector (up 42–47% on 2007's $116m).

www.veeco.com

Late in Q2, Veeco completed the purchase of Mill Lane Engineering of Lowell, MA (a key tool supplier to Global Solar Energy Inc of Tucson, AZ, USA), expanding its solar product line to include web coaters for flexible copper indium gallium diselenide (CIGS) photovoltaics. The business had no contribution to revenue due to purchase accounting requirements and the timing of the acquisition's completion, and no new orders for web coaters were received during the quarter.

"We are in conversations with key solar companies focused on flexible photovoltaic technology," says CEO John R. Peeler. "Initial customer feedback is that the Mill Lane web coaters are very well designed and competitive for size, cost of ownership and other critical characteristics," he adds. "We are positioning Veeco to be a supplier of complete lines of vacuum processing tools for CIGS and other flexible photovoltaic applications. Veeco's proprietary line of CIGS thermal sources, combined with our unique thin-film process knowledge, provides a key market advantage," he continues. "We believe our timing on entering this market is right, as many of the CIGS companies are in the R&D stage and require additional support from an equipment partner to be successful as they move to production."

Veeco launches web-coating system for flexible CIGS PVs

Veeco Instruments Inc of Plainview, NY, USA has launched its FastFlex line of web-coating systems for making copper indium gallium diselenide (CIGS) solar cells. The firm says the FastFlex web deposition platform offers high throughput and excellent performance for flexible thin-film solar cell production, contributing to a lower cost of ownership due to the high quantity of deposition zones in a compact footprint.

The FastFlex platform consists of three systems: one for the transparent conductive oxide (TCO) using reactive sputtering, one for metal deposition with sputtering (the molybdenum layer), and one for the CIGS layer, integrating Veeco's proven PV-Series thermal deposition sources. The firm says that, to help deliver high throughput, the FastFlex system features a flexible architecture that can be configured to specific needs, with a choice of rotary or planar magnetron cathode assemblies, loading and maintenance requirements.

Veeco's new FastFlex web-coating system.

"Veeco now provides comprehensive, fully integrated manufacturing solutions for the moly, CIGS and TCO layers — enabling customers to achieve full-scale commercialization of flexible solar cells," says Dr Piero Sferlazzo, senior VP of Veeco Solar Equipment. "Our CIGS systems can be tailored to our customers' requirements and help drive down their cost per watt," he adds.

"Veeco is the industry's only thin-film deposition equipment supplier that provides production-proven thermal sources integrated into a CIGS web coating system," according to Sferlazzo. "This differentiation allows our FastFlex platform to provide CIGS customers with an excellent, high-throughput deposition solution as they move from R&D to production." FastFlex systems offer superior material utilization, excellent thickness uniformity, and the ability to process web widths of up to 350mm with an architecture that supports widths of 1m or more for metal as well as polyimide substrates, adds the firm.

www.veeco.com

Monocrystal launches 8" sapphire wafers for LEDs

Sapphire substrate maker Monocrystal of Stavropol, Russia has started production of ultra-large 8" c-plane epi-ready sapphire wafers for LED manufacturing.

Over the past few years the solid-state LED market has been transitioning from conventionally used 2" wafers to more economically efficient larger-diameter 3" and 4" wafers. "The introduction of our 8" wafers reflects growing demand in the global market for larger-diameter products," says VP sales & marketing Oleg Kachalov.

The firm has been able to ramp up production of the new-generation sapphire wafers rapidly by leveraging its technology for growing large sapphire crystals — it has routinely produced large sapphire crystals exceeding 65kg since late 2005.

Monocrystal says that another key factor is its proprietary wafer fabrication technology, developed earlier in spring for producing 8" r-plane sapphire wafers for RFICs. The firm has already shipped 8" wafers to LED and RFIC makers.

Monocrystal's 8" sapphire wafer versus a 2" sapphire wafer (left).

Availability of the 8" c-plane wafers for LED, coupled with Monocrystal's capacity (enabling high-volume production of sapphire crystals and wafers of ultra-large diameter) provides opportunities to benefit from increased performance and lower production costs for both conventional and high-brightness LEDs. "It is expected that this will lead to a significant price reduction for LEDs," Kachalov says. "Our 8" wafers could be a trigger for mass demand and large-scale adoption of solid-state general lighting," he adds.

"Being first to market with our ultra-large 8" wafers for LEDs is a clear indication of Monocrystal's growing brand exposure and recognition, its expanding market and technology leadership," reckons Vladimir Polyakov, chairman of Monocrystal's board and president of parent firm Energomera Corp. "Monocrystal exports 90% of its production, and is a key supplier for LED and RFIC markets," he adds.

www.monocrystal.com

K&S acquiring Orthodyne and divesting Wire business unit

Chip assembly equipment and packaging materials supplier Kulicke & Soffa Industries Inc of Fort Washington, PA, USA has agreed to acquire privately held Orthodyne Electronics Corp of Irvine, CA, USA (a supplier of ultrasonic wedge bonders and wedges for the power management and hybrid module markets) and to divest the K&S wire business unit to precious metals and technology group W.C. Heraeus GmbH (whose Contact Materials Division already manufactures bonding wire).

Orthodyne's focus on the fast-growing power management market has delivered a double-digit compound annual revenue growth rate over the last five years, resulting in 2007 revenues of $110m. Its executive team, led by Gregg Kelly, will be retained, as will all 280 staff.

K&S will fund the acquisition with about 7.1 million shares of its common stock plus $80m in cash. However, if the transaction is not consummated by 31 October, then the purchase price will be about 19.6 million shares and no cash. The deal includes possible earn-out consideration up to a further $40m in cash if certain financial objectives are met by Orthodyne over the next three years. The closing of the transaction (expected within 60 days) is subject to certain closing conditions, including regulatory approvals.

"The acquisition of Orthodyne is in line with our stated strategy, and positions K&S to capitalize on our strengths in equipment manufacturing and further cement our position as the leading supplier of interconnect solutions," says chairman & CEO Scott Kulicke. "Orthodyne is a fast-growing, profitable market leader and provides us with deeper penetration into the discrete side of the semiconductor market, particularly in the attractive power management and hybrid module markets."

Heraeus will pay $155m for K&S' wire business unit, subject to certain working capital adjustments. K&S and Heraeus say that they will also enter into a strategic technical collaboration agreement that provides reciprocal access to R&D expertise to exploit the technical synergies that come from approaching the wire bond process as a system involving the bonder, the tools and the wire. The closing of the transaction (expected within 60 days) is subject to certain closing conditions, including regulatory approvals.

"The wire business is one we believe strongly in, especially with exciting new wire products such as MaxSoft," says Kulicke. "It is a very healthy business, with excellent customer relationships, and it will be a very solid asset for Heraeus. However, the working capital requirements of this business have become significant and, as a result, no longer make financial sense for us," he adds.

Orthodyne provides us with deeper penetration into the discrete side of the semiconductor market

"Heraeus is ideally positioned to support the continued growth and exploit the advanced wire products we have developed in this business by leveraging its significantly larger balance sheet. The wire business fits very well into the core competences of Heraeus, which deal with precious metals and all related services such as refining and trading worldwide," Kulicke considers.

"One of the key considerations in selecting a buyer from what was a robust bidding process was the ability to develop a long-term strategic alliance with a partner we knew well and respected," he concludes. The technology alliance formed with Heraeus should allow K&S to exploit technical synergies between the two businesses, Kulicke reckons.

"W.C. Heraeus intends to continue building on its market position and strengthen its presence in Asia and North America," says Dr Peter Kohler, managing director of W.C. Heraeus (the largest business segment of the Heraeus Group). "The acquisition of the K&S wire business unit and its production facilities in Singapore and Switzerland will strengthen our market position, especially in Asia, which is the focal point of the world's semiconductor industry and a strategically important site in close proximity to customers," he comments.

Considering K&S' fiscal 2007 results, both as-reported and theoretically with Orthodyne and without the wire business, the transactions would have significantly improved gross margin, from 25.8% on actual sales of $700m to 45.9% on hypothetical sales of $481m, according to K&S' chief financial officer Maurice Carson. "Orthodyne is a profitable and growing business. Additionally, the divestiture of our wire business would have significantly reduced the working capital needs of the company and improved cash flow," he says.

"Coupled with last year's acquisition of Alphasem, K&S will posses a core competency across a full suite of interconnect technologies for a variety of micro-electronic applications," concludes Kulicke. "K&S will also serve a larger total available market for back-end assembly equipment, providing more growth opportunities as the industry's cycle begins to turn up in the future."

www.kns.com

Luxtaltek orders Obducat NIL tools for PhC LED mass production

Obducat of Malmö, Sweden, which supplies nano-imprint lithography (NIL) and electron-beam lithography systems, has received an order from Luxtaltek Corp of Taipei, Taiwan worth SEK22.5m ($3.5m) for mass producing photonic-crystal LEDs. The order includes a Sindre 60 NIL tool with a throughput of 12 wafers per hour (for delivery in September) and a fully automated Sindre 400 NIL tool with a throughput of 30 wafers per hour for 2–4" wafers (for delivery by the end of Q1/2009). Obducat will also supply consumables used in the NIL systems over the next 3–5 years in a deal worth up to SEK80m ($12.5m).

LuxtalTek was founded earlier this year by Taiwanese LED makers Uni-light Touchtek Corp and Taiwan Oasis Technology Corp, and has raised more than $10m in funding. In April, LuxtalTek acquired the photonic-crystal intellectual property of Mesophotonics Ltd (a spin-off of the University of Southampton, UK). President Dr Sean Lin is leading a team specializing in III-V materials and nano-fabrication working on the commercialization of photonic-crystal (PhC) LEDs.

Luxtaltek aims to provide PhC wafer patterning services and customized PhC LED chips and modules, beginning production of GaN-based PhC LED wafers in Q4/2008. The firm plans to set up eight lines with the capacity for 200,000 PhC LED wafers/month by the end of 2010.

"With their strong IP-portfolio within optoelectronics and their aggressive market approach, we expect to see a quick growth of Luxtaltek and consequently we foresee additional orders regarding mass-production equipment," says Obducat CEO Patrik Lundström.

"We are very pleased to get the commitment from Obducat to fully support the Luxtaltek production expansion plan for the next two years, which involves another five Sindre 400 systems and several Sindre 60 systems," says Lin.

"This is a highly interesting market with a potential for NIL equipment in the range of €100m over the next five years," says Lundström.

www.obducat.com

KLA-Tencor president & COO departs

John Kispert is to leave the post of president & chief operating officer of process control and yield management solutions provider KLA-Tencor Corp of Milpitas, CA, USA at the end of 2008. His management responsibilities will be assumed by CEO Rick Wallace.

"John has been a key contributor at KLA-Tencor for many years," says Wallace. "He has seen us through the implementation of numerous strategic initiatives, multiple acquisitions, the addition of new global facilities, the launch of industry-leading products and much more."

Kispert joined KLA-Tencor in 1995, and was appointed president and COO in January 2006 and interim chief financial officer this March.

New CFO Mark P. Dentinger will report directly to Wallace. "Mark is a seasoned executive with experience at publicly held hardware and software companies and he brings a strong financial and accounting foundation, which we are confident will benefit the company and our investors," says Wallace.

From February 2005 to this April, Dentinger was executive VP and CFO for BEA Systems Inc until it was acquired by Oracle. Previously, he served in financial management positions at Compaq Computer Corp (now Hewlett-Packard) for six years, where he became director of finance, high-performance systems manufacturing in 1996.

www.kla-tencor.com

Sapphire substrate maker Rubicon grows 40% annually

For second-quarter 2008, Rubicon Technology Inc of Franklin Park, IL, USA, which manufactures sapphire substrates and products, has reported revenue of $11.5m, up 10% on last quarter's $9.5m and up 40% on $8.2m a year ago.

Of total sales, 10% came from optical applications, 60% from LED makers, and 30% from silicon-on-sapphire (SoS) electronics applications. Growth in the latter sector (mainly to Peregrine Semiconductor Corp of San Diego, CA) correspondingly pushed the proportion of total sales from North America up to 44%, with 54% from Asia and just 2% from Europe.

Of total substrate revenue, large diameter products (3-inch or greater) have risen from 42% a year ago and 58% last quarter to 60%. This is due to the increase in 6-inch wafers sold for SoS and the migration of LED makers to larger-diameter substrates.

Silicon-on-sapphire revenue grew 173% year-on-year and 18% sequentially as Peregrine's products continue to displace conventional solutions (since its SoS technology allows for a very high level of system-on-chip integration for high-frequency RFICs).

Revenue from LED substrates grew 14% year-on-year and 8% sequentially to $6.9m, with market share continuing to expand through both increasing business with existing customers and adding new key customers in Europe, Japan, Taiwan, Korea, and China. Revenue for 2- and 2.5-inch diameter substrates fell 2% year-on-year, to 60% of LED substrate revenue (compared to 65% plus for the general LED market). Reflecting Rubicon's continued migration to larger-diameter substrates, 3- and 4-inch revenues grew 54% year-on-year, taking more than 50% share of the overall 3- and 4-inch LED substrate market, Parvez reckons.

Operating margin was 15.6%, or 20.3% excluding $544,000 in costs from its secondary offering of shares (up from 11.5% a year ago and 14.1% last quarter). This was driven by stringent control of operating expenses and gross margin rising from 34.4% a year ago and 36.8% last quarter to 37.6% (reflecting the shift in product mix towards higher-margin large-diameter products). Net income was $2.2m, up from just $232,000 a year ago.

However, customer payments have slowed due to tighter cash flow at some key customers as a result of macroeconomic conditions. In particular, in Taiwan and Korea, a reduced rate of growth in cell-phone and small-display applications has affected LED markets. Taiwan and Korea are in early-stage development for large-diameter LED chip production and therefore remain largely focused on small-diameter wafers. Consequently, the rate of growth for LED applications that use 2-inch diameter substrates has slowed in the past quarter. Slower-than-expected growth in Taiwan has increased pressure on pricing for smaller-diameter products as customers strive to increase their market share.

So, in response to current market conditions, Rubicon has been adjusting pricing as necessary on smaller-diameter products. President and CEO Raja Parvez says that Rubicon had expected an overall year-on-year decline in average selling price (ASP) of 5%, but it is now looking at 7% ASP declines (virtually all due to 2-inch substrate business).

In 2009, the market in Taiwan and Korea is expected to pick up as demand for high-performance LED applications such as large-area display backlight units and solid-state lighting for general illumination is growing rapidly. LED backlight units are penetrating into the notebook computer and LCD TV market faster than expected, especially since Taiwanese LCD flat-screen display makers AU Optronics and Chi Mei Optoelectronics have entered LED chip making and will start volume production in early 2009 (e.g. with AU recently stating that its goal of adopting LED backlighting for all of its LCD notebook panels by 2011 may be achieved one year earlier). Rubicon is already supplying blank wafers to the polishing companies that are supply finished substrates to these companies, says Parvez. These applications need larger-diameter sapphire wafer to support the larger chip sizes necessary for higher brightness and also to optimize throughput to reduce cost. Such applications are also being supported by major LED chip makers in Japan, Europe, and North America, says Rubicon.

Rubicon adds that several LED makers have now acquired MOCVD reactors capable of 6-inch epitaxial growth, and it has consequently received orders from multiple LED chip-making customers for 6-inch substrates to support next-generation LED wafer development efforts. Also, a lot of 6-inch back-end processing equipment is already available from the silicon industry, making it more economical for LED makers to migrate to 6-inch substrates. Volume 6-inch production should be seen in 12–18 months, Parvez reckons. "We expect this large-diameter development to ramp as LED makers continue to increase device performance and drive LED costs down to further penetrate lighting applications," says Parvez.

Likewise, Rubicon recently provided 8-inch sapphire wafers to Peregrine for its next-generation products. RFICs on 8-inch SoS are expected to provide considerable benefits in terms of device performance and lower total cost of ownership. Rubicon expects the SoS market to grow 50% annually over the next several years.

However, a near-term challenge to SoS business is that Peregrine has recently restructured by moving to a fabless business model, selling its internal wafer production facility. It is outsourcing 95% of its wafer pro-

duction to three external foundry partners. Two of the foundries (in Taiwan and Korea) are being qualified, involving Rubicon's substrates. However, the initial foundry partner (now in volume production) has also bought wafers from another supplier. Rubicon therefore believes that Peregrine is beginning to accumulate an inventory of substrates. Rubicon has a contract for the remainder of 2008 that calls for increased volume each quarter, but the situation could impact new SoS orders for early next year. "We believe that Peregrine is addressing the issue in order to have better control over the sapphire procurement in 2009 and beyond," says Parvez. Peregrine says that Rubicon will continue to be their majority supplier, reports Parvez, who adds that the SoS market should continue to grow at a very significant rate.

"Current macroeconomic conditions are impacting certain segments of the LED market and we must be mindful of the SoS inventory situation," says Parvez. "However, given the increasing rate of adoption of LEDs in many applications such as large-area screen, backlight units and solid-state lighting and of SoS RFIC products, we expect continued growth," he adds.

For third-quarter 2008, Rubicon expects revenue to grow 9% to $12.5m. Q3 will be a challenge for gross margin, says chief financial officer Bill Weissman. Due to the current aggressive pricing environment for 2-inch products, gross margin may be slightly lower than the previously forecast 35% (perhaps about 34%). However, the longer-term target of 36-38% is unchanged, with upside to that depending on the timing of adoption of solid-state lighting applications and larger-diameter substrates, says Weissman.

Given the increasing rate of adoption of LEDs in many applications such as large-area screen, backlight units and solid-state lighting and of SoS RFIC products

At the end of Q2, order backlog was $27.1m: $24.6m for delivery in 2008 and $2.5m for 2009. "Despite macro-economic conditions impacting a portion of the LED market and some build-up of inventory in the silicon-on-sapphire market, our outlook for the full year 2008 remains unchanged," says Weissman, i.e. revenue of $47-49m (up 38-44% on 2007's $34.1m).

Rubicon is therefore continuing its aggressive expansion plan, with furnace installations at its new Bensenville crystal growth facility ahead of schedule, says Parvez. Capital expenditure (CapEx) is on budget, with $6.2m in Q2 bringing it to $10.7m year-to-date as Rubicon also continues to add capacity to post-crystal-growth operations. The firm expects to add $23m in revenue-generating capacity by the end of 2008.

www.rubicon-es2.com

Rubicon starts producing 8" sapphire for Peregrine

Rubicon Technology Inc of Franklin Park, IL, USA has begun initial production of 8-inch sapphire wafers for supply to Peregrine Semiconductor Corp of San Diego, CA, USA, which designs and manufactures RF communications ICs, for its proprietary UltraCMOS mixed-signal silicon-on-sapphire (SOS) processing, a patented variation of silicon-on-insulator (SOI) technology on a sapphire substrate that, Peregrine claims, provides high yields and competitive costs.

"Rubicon aggressively ramped 6-inch sapphire substrates to support our high-volume production requirements throughout 2007 and the first half of 2008," says Peregrine's CEO Jim Cable. "Last year we nearly tripled our unit volume with key design wins in the rapidly growing wireless marketplace in some of the world's most demanding RF applications.

"Rubicon has leveraged its unique crystal growth technology platform to rapidly develop very high-quality 200mm sapphire wafers that represent the next-generation substrates for SOS RFIC technology," says Rubicon's president and CEO Raja Parvez. "As we migrate to 8-inch wafers and smaller geometries, our customers will benefit from unprecedented product performance and cost-effectiveness," reckons Peregrine's Cable.

The expansion to 8-inch sapphire wafers reflects the growing demand for UltraCMOS SOS RFICs, Peregrine says. In recent years the firm has brought to market a variety of devices that, the firm claims, deliver performance objectives set by customers with highly stringent RF design requirements including global cellular, navigation/communications, and cable/digital TV (CATV/DTV) firms.

UltraCMOS devices are becoming increasingly critical in high-performance RF designs, Peregrine claims. Continued enhancements to the fundamental design technology, such as HaRP technology (which enables improvements in harmonic results, linearity and overall RF performance; specifications required by the 3GPP standards body for GSM/WCDMA applications), combined with the insulating sapphire substrate, result in an extremely linear FET with exceptional RF performance, the firm adds. Peregrine says that the ability to integrate high-performance RF, analog, digital, passive elements and non-volatile memory on a single, standard CMOS IC differentiates UltraCMOS devices from compound semiconductor and other mixed-signal processes.

www.psemi.com

Osram LEDs illuminate 'Dragon Fountain' at Olympics

Osram Opto Semiconductors GmbH of Regensburg, Germany and China's Tsinghua Tong Fang Co Ltd teamed to illuminate the dragon-shaped water fountains in Beijing's Olympic Park with Osram's Golden Dragon LEDs.

In July, Tong Fang installed its dragon-shaped water fountains along the northeast side of the Bird's Nest and the Water Cube in the Olympic Park. The fountains were outfitted with Osram Golden Dragon with lens and enhanced Thinfilm LED components, providing their golden glow.

Projects like the dragon-shaped fountains reflect the expanding opportunities that customers are finding to create original LED solid-state lighting applications, says Osram. More than 600m long, the 'Dragon' is formed by thousands of water jets arranged in a long curve cutting through the Olympic Park, comprising a river stretching 2km. The jets launch water columns as high as 6m, creating a kind of rolling wave (resembling the body of a dragon gliding through the air). At the base of each column, mounted 10cm underwater, a lamp containing 24 Osram Golden Dragon LEDs radiates yellow light upwards to a height of 15m, illuminating the 'dragon' for 4–5 hours every evening. Altogether, 1920 lamps containing 46,080 Golden Dragon LEDs help bring the dragon fountain to life.

LED-illuminated Dragon fountains in Beijing's Olympic Park.

Osram Opto says that partnering with Chinese companies such as Tong Fang (with which it has worked before) is key to developing China's LED market. "This kind of innovative and creative thinking is precisely how we aim to revolutionize the lighting industry in China and the rest of the world," says Osram Opto Semiconductors Asia's CEO Dr Alfred Felder.

Osram Opto claims that its Golden Dragon with lens and enhanced Thinfilm LEDs come with one of the narrowest viewing angle integrated lenses in the industry (just 20°), taking up less space and reducing the need for secondary optics. Also, the high optical efficiency (61lm/W) of the yellow LEDs enhances energy efficiency, while the lifespan of more than 50,000 hours (under appropriate operating conditions) minimizes maintenance costs.

www.thtf.com.cn

Federal president visits winners of German Future Prize at Osram

Germany's Federal President Horst Köhler, accompanied by Bavarian Minister of State Dr Beate Merk, has visited the winners of the 2007 German Future Prize at Osram's Regensburg site, with laureates Dr Klaus Streubel, Dr Stefan Illek (both of Osram) and Dr Andreas Bräuer (of the Fraunhofer-Institute for Applied Optics and Precision Engineering) giving a progress report on the award-winning project 'Light from crystals – light emitting diodes shape our daily lives'.

Last December the team was presented with the President's Prize for Technology and Innovation for the development of thin-film chip technology and its use in Osram's OSTAR family of LEDs.

The prize winners received Köhler together with Osram Opto Semiconductors' CEO Dr Rüdiger Müller, Osram president Martin Goetzeler, and the CEO of Siemens Sector Industry Dr Heinrich Hiesinger.

Bräuer, Illek, president Köhler and Streubel (from left to right).

As examples of future applications, Osram experts presented products including daytime running lights for automobile headlights, the first table light based on organic light emitting diodes (OLED), and laser diodes for projectors.

"We invest 13% of our sales in opto semiconductors in R&D activities in this sector," said Goetzeler. "Since 2001 we have also expanded our Regensburg site into the most advanced opto chip factory in the world on the back of a triple-digit million euro budget. Today more than 1500 employees work here — around 500 more than seven years ago."

The winning team has donated most of the prize money to building a children's daycare facility to be run by the company.

www.osram-os.com/german-future-prize-2007

Osram Opto appoints Eckstein as chief operating officer

Elke Eckstein has assumed the post of chief operating officer (COO) at Osram Opto Semiconductors GmbH in Regensburg, Germany, responsible for worldwide production.

Predecessor Jörg Thäle, who held the post from 2006 to April 2008, is now CEO of parent company Osram GmbH's Low Pressure Discharge business unit.

Eckstein brings more than 25 years of experience in the semiconductor sector, as well as extensive specialist knowledge. Most recently, she was VP of manufacturing at microprocessor manufacturer AMD's plant in Dresden, Germany, responsible for day-to-day operations of F30/38 (which is reckoned to be the world's most efficient semiconductor fab).

Prior to AMD, Eckstein was CEO for three years at Altis Semiconductor, a joint venture between IBM and Infineon.

Osram Opto says that Eckstein has shown her strengths in technology development and product engineering at ProMOS Technology, an earlier joint venture between Infineon and Mosel Vitelic based in Taiwan.

Elke Eckstein, Osram Opto Semiconductors' chief operating officer.

Eckstein started her career in the Semiconductor Division of Siemens in Munich.

www.osram-os.com

IN BRIEF

Road tunnel lighting

Dellux Technologies of Montreal, Canada has selected Osram Opto's Golden Dragon LEDs for luminaires for the Thüringer Schmücketunnel (the first tunnel in Germany, and the longest in Europe, lit by LEDs).

Almost 800 luminaires will each contain nearly 100 LEDs. "We have installed redundant LEDs in each luminaire to offset soiling and degradation losses," says Wolfgang Medenwald, VP of business development (Europe). "We also operate the LEDs at only 85% of their rated current to achieve greater efficiency and durability."

Due to Dellux's LED Degradation Compensation technology, the luminaires use 30% less energy than the 70W high-intensity discharge lamps traditionally used (saving 10,000kWh annually).

www.osram-os.com

Nichia sues Seoul Semiconductor in USA and UK

In mid-August, Japanese LED maker Nichia Corp filed a patent infringement suit in the US District Court for the Eastern District of Michigan against Korean rival Seoul Semiconductor Co Ltd (SSC), its US subsidiary Seoul Semiconductor Inc and its US distributor Avnet Inc, alleging that SSC's LED products (including Acriche) infringe Nichia's US patent no. 6,870,191. The lawsuit seeks an injunction from future infringements and an award of damages.

After reviewing the patent, Seoul Semiconductor says that it plans to vigorously defend the lawsuit, since it believes that Nichia's lawsuit lacks merit and that the patent's LED substrate is patterned with a protruded and recessed trapezoid, which it claims is different from Seoul's products.

Seoul says that, in May, a federal judge in a lawsuit filed by Nichia in the US District Court for the Northern District of California, who denied Nichia's motions for an injunction and attorney's fees against Seoul, noted that Nichia seemed to be using lawsuits "attempting to obtain some unstated ancillary advantage over defendants in Asia". Seoul believes that Nichia's latest lawsuit is a similar misuse of the legal process.

After recently invalidating one of Nichia's core LED patents in Korea for lack of novelty, in the latest lawsuit Seoul will seek to invalidate Nichia's 6,870,191 patent based on prior art.

● In mid-September, Nichia also filed a lawsuit in the UK alleging that Seoul's Acriche products infringe its patent EP(UK) 0 541,373 ('Method of Manufacturing P-type Compound Semiconductor'), which Nichia calls one of its most important patents (relating to a thermal annealing method for manufacturing p-type gallium nitride-based materials). Nichia is also claiming damages.

The patent is considered to be fundamental and indispensable for the mass production of GaN-based LEDs and laser diodes. Nichia believes that the chips in Acriche white LED products are manufactured using the process described in the patent. The firm says that it places great significance on the proper protection of intellectual property rights, and will continue to exercise its rights aggressively around the world.

Seoul finds it hard to see how Nichia's patent can be valid over Neumark's [earlier] patent and preceding technologies

In response, Seoul Semiconductor claims that its Acriche products are manufactured under a licence for related technology from Gertrude Rothschild Neumark (professor emerita of Materials Science and Engineering at Columbia University) and University of California, Santa Barbara (UCSB), and that it has the means to establish non-infringement of Nichia's patent. Seoul Semiconductor also believes that it has sufficient prior art to have Nichia's patent revoked as invalid.

Seoul Semiconductor adds that it finds it hard to see how Nichia's patent can be valid over Neumark's [earlier] patent and preceding technologies. Furthermore, the firm says that it has an opinion from a Japanese patent specialist that multiple similar technologies have existed before.

Seoul Semiconductor says that it has raised proposals to bring invalidity lawsuits against Nichia's patents and have them revoked. Other lawsuits brought by Seoul to invalidate Nichia's patents are already on-going in the USA, Japan and Korea. "We pursue revocation actions to protect stockholder's rights," says Seoul.

Korean IP tribunal rules Nichia's patent lacks novelty

Korea's Seoul Semiconductor Co Ltd is claiming victory against rival Japanese LED maker Nichia Corp in a patent invalidation proceeding filed with the Korean Intellectual Property Tribunal (KIPT). On 23 July, KIPT ruled that Nichia's Korea patent number 406201, which had been asserted in an infringement lawsuit against certain Seoul products, has been invalidated for lack of novelty. Based on the ruling, Seoul believes that it cannot infringe Nichia's patent.

Seoul also contends that its technology is different from Nichia's now-invalidated patent.

A counterpart of this patent was also asserted against Seoul by Nichia in the UK in May. With the KIPT's ruling, Seoul believes that the Nichia patent invalidation will have a very positive effect in the UK for Seoul and its distributors such as Avnet EMG Ltd.

Previously, in the USA, Seoul submitted a request to the ITC (International Trade Commission) to prohibit importation of Nichia's laser diode into the US market, claiming that Nichia infringed Seoul's patent. Subsequently, in January, the ITC granted Seoul's request for an investigation into possible patent infringement by Nichia. The ITC is expected to render its decision in early 2009. Seoul also has additional patent infringement actions in the USA and other countries claiming infringement by Nichia's LED, ultraviolet (UV) LED, and laser diode (LD) products.

Seoul says that it respects intellectual property rights of other companies and expects others to do the same. The firm maintains about 1600 patents and over 300 patents that relate to fundamental technology in the field of LEDs.

www.seoulsemicon.com
www.nichia.com

Rothschild considers adding firms to ITC LED patent case

Gertrude Neumark Rothschild, professor emerita of Materials Science and Engineering at Columbia University, is considering including additional firms in her patent infringement lawsuit at the US International Trade Commission (ITC).

Rothschild filed the complaint ('In the matter of Short-Wave Light Emitting Diodes') on 19 February, alleging infringement by 31 firms of US patent 5,252,499 (issued in 1993, covering a method of producing wide-bandgap semiconductors for LEDs and laser diodes emitting in the blue, green, violet and ultraviolet end of the spectrum). The ITC instituted an investigation on 20 March.

Rothschild began her research career in private industry, working with Sylvania Research Laboratories in Bayside, NY in the 1950s and later at Philips Laboratories in Briarcliff Manor, NY before joining Columbia as a professor of materials science in 1985. She conducted research in the 1980s and '90s into the electrical and optical properties of wide-bandgap semiconductors that is claimed to have been pivotal in the development of short-wavelength emitting (blue, green, violet and ultraviolet) diodes now used in consumer electronics. While Rothschild's patent is not limited to gallium nitride-based material in LEDs and laser diodes, the total market for all types of GaN devices alone has been forecast at $7.2bn for 2009.

The lawsuit seeks to bar importation into the USA of a wide range of consumer electronics products incorporating infringing LED and laser diode devices. These include video players using Sony Corp's Blu-ray format, Motorola Razr mobile phones and Hitachi digital camcorders, as well as instrument panels, billboards, traffic lights and data storage devices. Other firms cited include Blu-ray DVD player makers Matsushita Electric Industrial Co (Panasonic), LG Electronics Inc and Samsung Group and HD DVD player manufacturer Toshiba Corp, as well as Nokia Corp, Sony Ericsson Mobile, Pioneer, Sanyo Electric Co Ltd, and Sharp Electronics.

We remain open to discussions, both with respondents and those not yet in the action

Rothschild has already reached licensing deals with 13 firms, including Sony, Sanyo, Seoul Semiconductor Co Ltd, LG Electronics, Lucky Light Electronics Co Ltd, Everlight Electronics Co Ltd, Samsung Electro-Mechanical, Seiwa Electric Mfg Co Ltd, Shenzhen Unilight Electronic Co Ltd, Guangzhou Hongli Opto-Electronic Co Ltd, Samsung Electro-Mechanics Co Ltd, Samsung Electronics Co Ltd, and Lite-On Inc.

In addition, several firms that were not named in the ITC case have expressed interest in reaching licensing agreements. "We have been asked to review which other companies should be added to the ITC action," say Dreier LLP intellectual property partners Albert L. Jacobs Jr and Daniel Ladow, representing Rothschild. "We have found several companies which we believe can and should be added," continues Jacobs. "While doing that, we remain open to discussions, both with respondents and those not yet in the action."

www.dreierllp.com

LED 'shimmer wall' lights up Raleigh convention center

On 4 September, the grand opening of the new 500,000ft^2 convention center in downtown Raleigh, NC, USA will include unveiling a 'shimmer wall' art installation adorning one side of the exterior, funded by a $1m donation from local LED maker Cree Inc.

Raleigh was the first city to join the LED City program, which is a community of government and industry parties launched with Cree in February 2007 to promote and deploy LED lighting technology across municipal infrastructure. The program has since been joined by Ann Arbor, MI, Austin, TX and Anchorage, AK in the USA, Toronto, Ontario in Canada, and Tianjin in China.


'Shimmer wall' at Raleigh's convention center

Covering up the convention center's air-conditioning system from the 80,000 motorists per day entering downtown Raleigh from the south, the 211ft long by 44ft high shimmer wall consists of 79,464 4-inch squares ('pixels') of aluminum that hang on louvers in 4ft-square grids. Since Raleigh's nickname is 'City of Oaks', in daytime the wall will depict an oak tree that changes shape and disappears as the aluminum squares ripple in the breeze.

However, to aid night-time 'shimmering', 1344 LEDs from Cree backlight the wall. The wall contains 28 fixtures, each 4 feet long with 12 LEDs per foot (including RGB lens optics). The fixtures can be programmed to flash and display more than a million different colors.

www.cree.com
www.raleighconvention.com

LED City gains Anchorage & Welland

In early September, Welland in Ontario, Canada joined the LED City program, an international community of government and industry parties initiated by LED maker Cree Inc of Durham, NC, USA to evaluate, deploy and promote LED lighting for municipal infrastructure. Welland has converted many of its lighting applications to LEDs, including streetlights and traffic signals, and has also amended its municipal standards to facilitate LED lighting for all future streetlight installations.

The 50 LED streetlights installed on Fitch Street, Welland, Ontario.

Streetlights in Torraca in Italy, converted to LEDs in late 2007.

Welland has already installed 50 LED streetlights along Fitch Street and is formalizing plans for the installation of 50 additional street and pedestrian lights. It is estimated that by retrofitting all its streetlights with LEDs the city could save $253,980 per year.

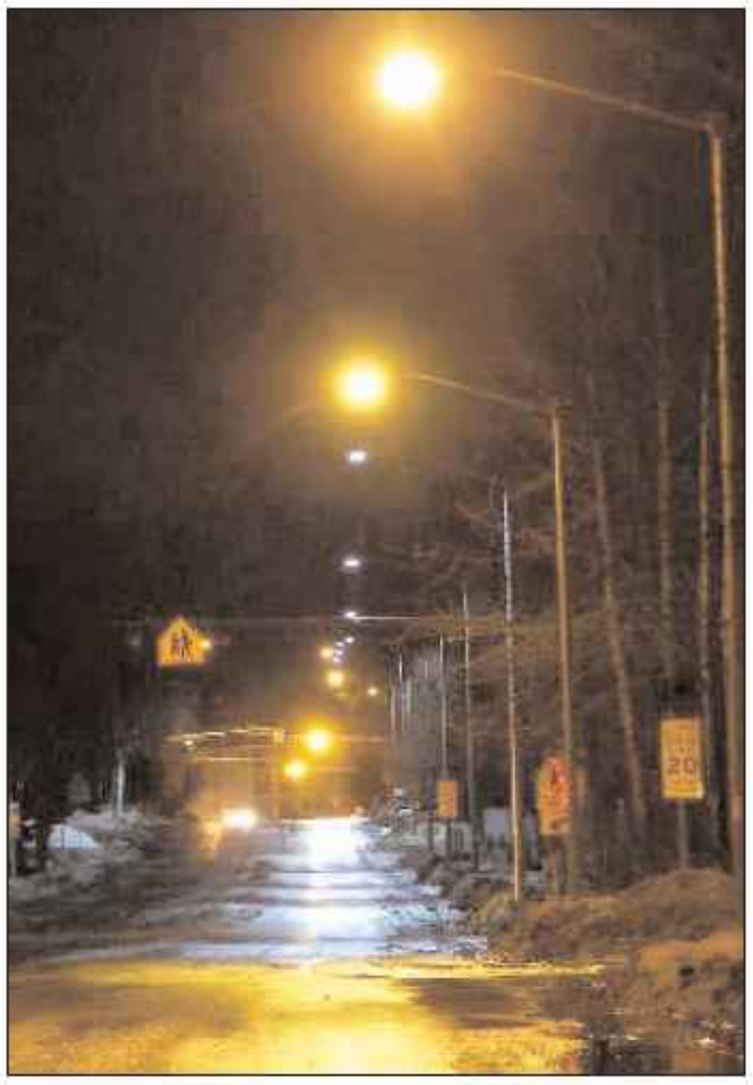
"The City of Welland is committed to high-quality LED lighting that reduces energy and maintenance costs," said mayor Damian Goulbourne. "Welland has been immersed in the testing of LED street lighting and aspires to become a green community, improving life for our residents. We look forward to promoting the benefits of our installations and sharing our experiences within the LED City program, helping to build a global municipal community committed to energy-efficient lighting."

In January, Toronto's greenTbiz organization undertook a public-perception survey of LEDs in Welland and found that 73% of all respondents preferred the new LED streetlights. The city now plans to convert its downtown decorative pedestrian lighting to LEDs as part of the its downtown revitalization project.

The 50 LED streetlights that are to be installed in Welland are based on the K56-EAR LED Series made by King Luminaire (which is part of the StressCrete Group), and contain LED light engines from Welland-based CRS Electronics. The light engines use the Cree XLamp LED.

At the end of July, the Municipality of Anchorage, AK, USA also joined the LED City program. The city's participation was announced in conjunction with an energy-related initiative calling for the retrofit of all 16,000 municipal roadway lights with high-efficiency LED fixtures.

"I am pleased to announce the appropriation of $2.2m to enable the city to purchase LED fixtures to change out roughly one-quarter of Anchorage's streetlights," said mayor Mark Begich. "We have studied new lighting technology extensively over the past several months to validate energy and maintenance cost savings. We also conducted a lighting conference and public survey in March of this year that showed our residents overwhelmingly approve of the new white LED lighting. With this feedback and quantified costs savings research in hand, we are confident in moving ahead with the broad deployment of LED lighting for our roadways."



Test of LED versus conventional street-lights in Anchorage.

BetaLED is supplying the LED fixtures, which are expected to use 50% less energy than current streetlights (saving the city $360,000 annually). The fixtures, based on Cree XLamp LEDs, typically last up to seven times longer than high-pressure sodium fixtures.

"Lighting is absolutely critical to daily life in Anchorage. The continental US has more than 8 hours of daylight per day. Here in Anchorage, approximately 85 days a year see less than 8 hours of daylight. It is significant that this community is at the forefront of adopting energy-efficient lighting," notes Deb Lovig, Cree LED City program manager.

Earlier this year, in May, Torraca in Italy officially joined the LED City program, following the conversion of all its streetlights to LED lighting late in 2007, which is estimated to have saved the city 75% in energy costs over traditional lighting.

Welland, Anchorage and Torraca join program members Raleigh, NC; Ann Arbor, MI; Austin, TX; Toronto, Ontario, Canada; and Tianjin, China.

www.ledcity.org

Cree opens Shenzhen engineering center for lighting design

LED maker Cree Inc of Durham, NC, USA opened the Cree Shenzhen Engineering Center in China, a technical education center dedicated to training lighting product designers and manufacturers in best practices for LED lighting product design and construction. Guests at the opening ceremony included Chen Yan Sheng, president of the China Association of Lighting Industry.

Co-located with the Cree Shenzhen sales office, the engineering center employs application engineering, technical and sales staff. Cree experts will teach courses and be available to consult with customers on XLamp LED-based designs, provide on-site handling guidance for LEDs during production, and evaluate LED designs for efficiency and performance.

Cree Shenzhen Engineering Center.

The modular curriculum, taught in Mandarin, aims to expand traditional lighting designers' and manufacturers' understanding and knowledge of using LEDs in general-illumination applications. The curriculum includes topics such as:

- the basics of LEDs;
- color theory and measurement;
- circuitry design for driving LEDs;
- optical design for XLamp LEDs;
- common problems and answers.

For designers creating efficient LED fixtures, using XLamp LEDs is only one element of a successful design, says George Li, Cree Hong Kong director of sales. "By helping our customers create more effective and efficient LED systems, we hope to accelerate the worldwide adoption of high-quality LED lighting."

www.cree.com

Intematix recruits Cree sales director

Intematix Corp of Fremont, CA, USA, which provides phosphors, LED components and solid-state lighting modules, has appointed Jeff Lagaly as VP of sales, LED Lighting.

Lagaly was formerly global sales director for Cree Lighting, overseeing the effort that introduced and drove Cree's XLamp LED line to sales estimated in excess of $100m.

"Jeff's background, with experience in both the chip and LED sides of the industry, is the perfect complement to the Intematix team," says CEO Peter Larsson. "As part of his responsibilities at Cree, he built both the inside and outside LED component sales teams, installed local and global distribution networks, and identified customer entry points worldwide which resulted in the development of Cree's fastest-growing business unit."

Intematix supplies patent-backed merchant phosphors, but recently it has expanded its vertical integration into LED lighting with the addition of packaged LEDs and LED arrays. Intematix also provides key modular components, along with integration and design assistance, which together enable traditional lighting companies to accelerate their entry into the solid-state and LED-based lighting market, the firm says.

"In the last year, Intematix has leveraged our phosphor and material experience horizontally, with a rapid expansion into a leadership position in CFL and CCFL phosphors, and vertically, with the recent introduction of our packaged power LEDs and LED arrays, the Apus and Cetus product lines," says Dr Yi-Qun Li, founder, CTO and executive VP. "While our materials-oriented business units continue their expansion, our LED business is providing the company with the kind of parallel opportunity that is only found in high-growth markets, such as solid state lighting," he adds.

"Intematix is helping traditional fixture manufacturers enter the solid-state lighting market," says Lagaly. "I expect to make the most of the initial traction Intematix has seen with its new LED and modular LED lighting solution portfolio," he adds.

www.intematix.com

IN BRIEF

Cree creates new post of chief operating officer

LED maker Cree Inc of Durham, NC, USA has recruited Steve Kelley to the newly created position of executive VP and chief operating officer, responsible for business development, global manufacturing, technology and administrative operations.

Kelley moves to Cree after five years at Texas Instruments, where he was VP and general manager of the Standard Linear and Logic Group. Previously, he spent 10 years in management roles at Philips Semiconductors.

"Steve's breadth of experience and track record of success in the semiconductor business will be a strong addition to the Cree leadership team as we drive the adoption of energy-efficient LED lighting," says chairman & CEO Chuck Swoboda.

www.cree.com

Cree grows 25% to record $493m revenue for fiscal 2008

For fiscal Q4/2008 (ended 29 June), LED maker Cree Inc of Durham, NC, USA has reported record sales of $135.9m, up 9% on last quarter and 22% on $111.2m a year ago (and exceeding April's guidance of $129–133m). This took fiscal 2008 revenue to a record $493.3m, up 25% on fiscal 2007's $394.1m.

"Q4 represented a strong finish to a very successful year," says chairman & CEO Chuck Swoboda. Non-LED business was flat sequentially at $19.2m as higher-power device sales were offset by slightly lower RF and government contract revenue. However, LED sales of $116.6m were up 11% on last quarter's $105m and 27% on $92m a year ago.

LED revenue growth was led by another double-digit increase in sales of XLamp packaged LEDs (which have grown 140% in full-year fiscal 2008 over fiscal 2007), stronger-than-expected double-digit growth in packaged high-brightness LEDs (with infrastructure build-out in China driving the large-area video display market), on-target sales of LED chips (a few percent down on Q3), and sales from LED Lighting Fixtures (LLF) of Morrisville, NC (acquired in March for $100m) within the target range of $2.5–3m.

Earlier this year, revenue from LED lighting components outpaced sales of LED chips for the first time in Cree's 21-year history. Overall, for Q4/2008, LED lighting component revenue was 30% higher than LED chip revenue, illustrating the progress made in building the LED component product line while maintaining a strong merchant LED chip business, says Swoboda. He adds that, over the last 18 months, Cree has executed its strategy to transition from an LED chip company driven by mobile phone market trends to a broad-based LED company with chips, components and systems.

"We made great progress on all five of the key objectives outlined for fiscal 2008," says Swoboda. "We grew XLamp sales more than 140% from the previous year and continued to drive the LED lighting revolution through our acquisition of LED Lighting Fixtures and the growth in our LED City and LED university market development initiatives," he adds. "We successfully integrated COTCO [of Hong Kong], which has become our high-brightness LED product line, and achieved a first-year revenue and profit objective [being accretive to earnings]." After transitioning production to China over the past year, Cree trebled XLamp packaging capacity at COTCO last quarter.

Non-GAAP gross margin was 34.2%, down for a second consecutive quarter and at the low end of the targeted 34–36%. This is due to three main factors: lower utilization in the LED chip and wafer fab as Cree chose to reduce inventory levels (by $3.2m to $80.2m); improvements in XLamp yields coming online later than forecast; and higher-than-targeted RF product and government contract costs.

For fourth-quarter 2008, LED lighting component revenue was 30% higher than LED chip revenue

Net income was $8.4m, up from $6.4m a year ago and $5.7m last quarter. However, full-year fiscal 2008 net income of $33.4m is down from fiscal 2007's $57.3m.

"While we recognize that there is caution in the market about the global economic environment, we remain optimistic about the year ahead as the momentum continues to build for our new products and energy-efficient lighting," says Swoboda.

In fiscal Q4, Cree launched several new LED lighting products, including: a new version of the LR6 designed for 220–240V electrical systems (for markets such as Europe and Asia); the LR4, a 4" architectural recessed LED down-light delivering up to 540lm of dimmable light from less than 11W of power; and the XLamp XP-E and XP-C LEDs (which have the smallest footprint in the industry for lighting-class LEDs, claims Cree, providing the same lighting performance and reliability as the XR-E and XR-C LEDs but in an 80% smaller package).

Also, at Lightfair International 2008, Cree demonstrated the XLamp MC-E multi-chip LED, which retains the same footprint as the XLamp XR family LEDs while providing four times the light output of the XR-E.

Cree is ramping up pilot production of both XP and MC products in Durham over the next couple of quarters, prior to transfer to COTCO in China in fiscal second-half 2009.

At the end of June, order backlog was $89.3m, up on $69.8m a year ago. Consequently, for fiscal Q1/2009 (ending 28 September 2008), Cree expects revenue to grow slightly to $138–142m due to higher LED sales (driven by further double-digit growth in XLamp and LLF products) offsetting a 10–15% drop in non-LED revenue (due mainly to lower revenue for both the power and RF product lines as well as government contracts). Power device customers have pushed out orders to rebalance their inventories, while some RF foundry jobs have been delayed, according to chief financial officer John T. Kurtzweil. "Despite these challenges we continue to win new designs and are optimistic about the potential for these product lines," he adds. "While we expect there will continue to be some fluctuation in these product lines over

the next year, we target the growth in the LED business to more than offset this variability."

Gross margin is targeted to rise slightly to 34–36% as Cree gets the full-quarter benefit from new XLamp product yields made at the end of last quarter plus slightly higher factory utilization (offsetting the negative impact of lower RF and power device revenues). "This quarter we are introducing two new XLamp products and two new LLF products into production," says Kurtzweil. "It will take time to work through the new product launch challenges and for the product yield to achieve targeted production levels."

Cree also targets capital spending of $18–20m, mainly for capacity additions, new product introduction and the continuing transition of LED chip production to 4" wafers.

For full-year fiscal 2009, Cree is aiming to build on the momentum created over the last year in driving revenue growth by focusing on LED lighting, says Swoboda, targeting growth from LED components and LLF (which is projected to be accretive to earnings by fiscal Q4/2009).

"We continue to expand our global sales coverage and drive growth with our distribution partners as component distribution sales more than doubled over the previous year. We expanded our manufacturing capabilities in Asia as we transitioned most of our XLamp LED production to China [COTCO] during the year, which reduced manufacturing costs and positioned these products for improved margins in fiscal 2009," says Swoboda. Cree plans a further doubling of XLamp packaging capacity in fiscal 2009.

"We recognize that there's a growing uncertainty around the world regarding the near-term global economic environment, especially in businesses that are affected by trends in consumer spending," says Swoboda. "While this is a challenge that all companies will need to manage in the year ahead, we continue to target growth opportunities for Cree in fiscal 2009 due to the increased adoption of LED lighting," he adds. "The LED lighting revolution continues to gain traction and our XLamp LED components and LED lighting solution product lines are well positioned to benefit from the growing demand for energy-efficient LED lighting," he believes.

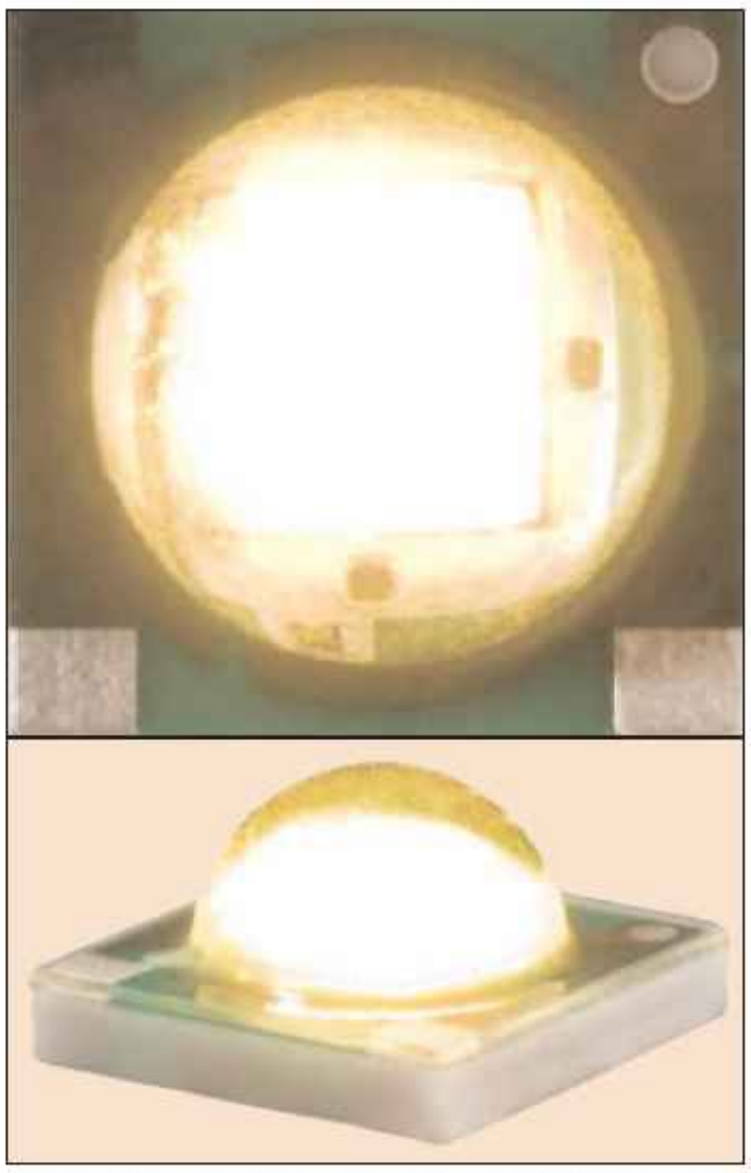
www.cree.com

Cree launches XP-E and XP-C: 'smallest lighting-class LEDs'

Cree has launched its XLamp XP-E and XP-C LEDs, which have the smallest footprint in the industry for lighting-class LEDs, it is claimed, measuring 3.45mm square by 2mm high (providing the same high-quality lighting performance and proven reliability as its XR-E and XR-C LEDs in an 80% smaller package). Small size and low profile, as well as a wide viewing angle and symmetrical package, enable applications including backlighting, signage, outdoor, indoor and portable lighting.

Available bins for XP-E LEDs include minima of 100 lumens at 350mA in cool white (5000–10,000K) and 80.6 lumens at 350mA in warm white (2600–3700K).

"We recognized an unmet need for lighting-class performance in a small-footprint, low-profile LED package. These products, based on an innovative new technology platform, address this need," says Paul Thieken, Cree's marketing director for LED components. "This new platform, in concert with the existing XLamp products and the recently demonstrated XLamp MC-E LED, give LED lighting designers enhanced flexibility and performance to further accelerate the LED lighting revolution."



View from above (top) and side (bottom) of Cree's XLamp XP-E LED.

www.cree.com/xp

IN BRIEF

Cree downlight wins Silver IDEA award

Cree says that its flagship LR6 LED recessed down light has won a silver International Design Excellence Award (IDEA) in the EcoDesign category. The competition, which this year received 1517 entries, was co-sponsored by the Industrial Designers Society of America and BusinessWeek.

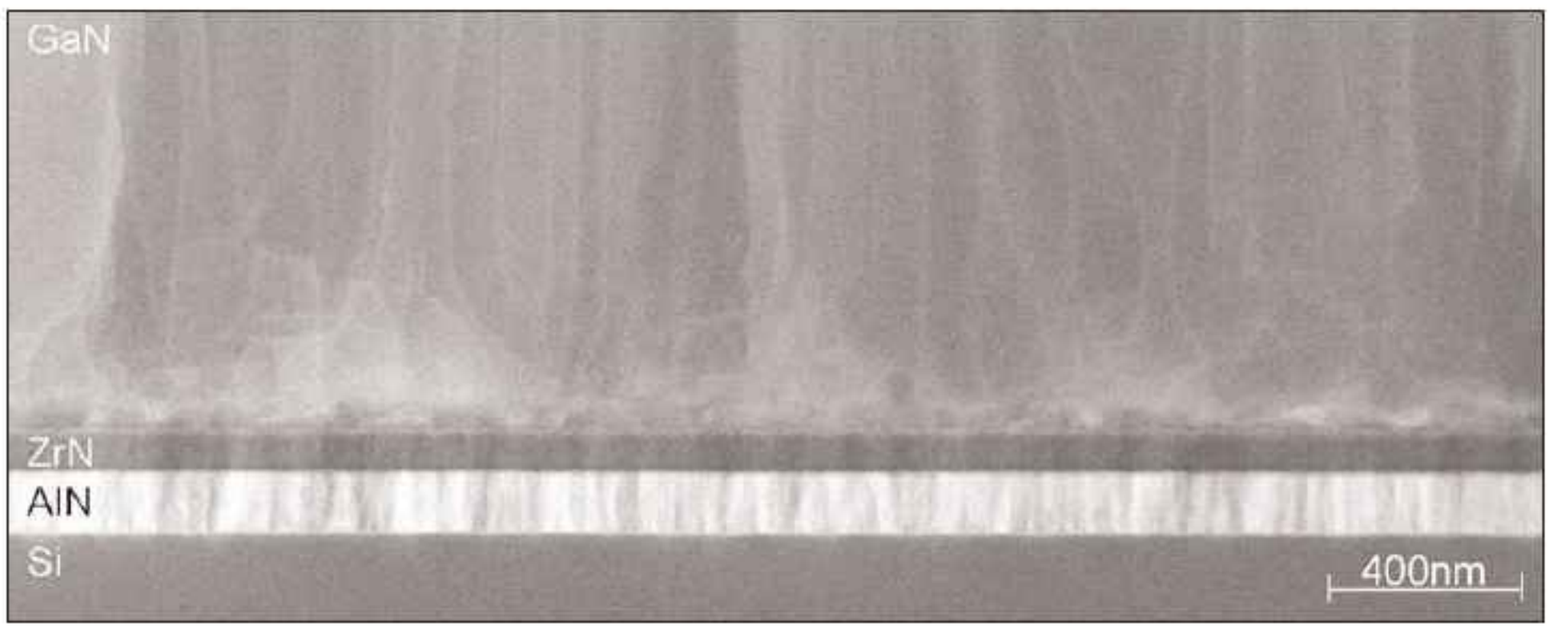
The LR6 is an all-in-one LED luminaire that converts six-inch recessed cans into energy-efficient lighting. It consumes 12W of energy, which is 85% less than a traditional incandescent and 50% less than a compact fluorescent. A unique feature, says the firm, is the available Edison base that allows the retrofit of existing cans in minutes with no rewiring or special tools.

www.CreeLLS.com

Back-reflectors for low-cost white light emitters

Researchers at Purdue University have developed a stack of materials on silicon that could lead to more efficient, lower-cost GaN LEDs [Oliver et al, App. Phys. Lett., **93**, 023109, 2008]. The stack includes a light-reflecting conductive layer that would boost light output from devices and provide an ohmic back-contact for the diode structure.

White LED-based lighting costs about $100 but, for significant market penetration, must be nearer $5.



Micrograph showing AlN and ZrN layers between GaN and the silicon substrate.

Light-emitting GaN devices are produced mainly on sapphire or silicon carbide substrates, depending on considerations of cost or power output. Sapphire was the first material on which GaN was grown to produce commercial LEDs, but the large lattice mismatch between materials (about 14%) leads to the GaN surface containing defects that impact device production yields, efficiencies and life-times. SiC substrates have a mismatch of ~3% and better thermal conductivity, but are much more costly to produce. Single-crystal bulk GaN is prohibitively costly to make. 'Free-standing' GaN is often produced on, and then separated from, one of the traditional substrates (sapphire or SiC).

Silicon (Si) is lower cost than sapphire, both in terms of raw materials and the economies of scale achievable using larger-diameter wafers — presently 300mm and perhaps going to 450mm, compared with sapphire's 100mm. Silicon also has better thermal conductivity than sapphire (though not SiC).

Silicon's main disadvantage is that it has an greater lattice mismatch (about 20%). Even so, some firms, such as Nitronex, have developed GaN/Si substrates for producing high-frequency RF transistors in volume. Others, such as Japan's Shimei Semiconductor, are developing GaN/Si LEDs, but products do not seem to be available yet.

Purdue's stack bridges the GaN–Si lattice mismatch with two layers, of aluminum nitride (AlN) and zirconium nitride (ZrN). The AlN provides a barrier between the Si and ZrN. Without the AlN, the ZrN and Si react, producing SiN and ZrSi, at the high temperatures used in MOCVD for GaN (more than 1000°C). While MBE deposition can be performed at lower temperatures (about 600°C), the process is more time consuming and difficult to apply in mass production. Such Si–ZrN reactions lead to opaque GaN layers and blistering.

Added advantages of an AlN barrier are its high thermal conductivity and the electrical insulation that it could provide between devices on the same die emitting at different wavelengths. The ZrN layer could also be used in a lattice-matched form with green-light-emitting $In_{0.14}Ga_{0.86}N$.

The ZrN/AlN/Si stack was produced by using dc magnetron sputtering to first deposit a thin layer of Al metal to protect the silicon from nitridation. An argon–nitrogen gas mixture is then used to convert the Al to AlN. This was followed by further AlN deposition and then the ZrN layer. Various layer thicknesses were investigated: 80450nm for AlN and 70300nm for ZrN. Deposition speeds were about 60nm/hr for AlN and 80nm/hr for ZrN. A thin (~3nm) AlN capping layer was deposited to protect the ZrN from oxidation. The cap is also thought to cut ZrN/GaN contact resistance by lowering the effective barrier between materials.

The 2002000nm GaN layer was grown by MOCVD at up to 1020°C. The sharpness of x-ray diffraction peaks, as derived by 'rocking' the material in various directions, gives an indication of the crystal quality — the narrower the curve, the better the crystal. Excluding the Si substrate, which has very narrow peaks due to its highly crystalline nature, the crystal quality improves between the AlN up to the GaN layer. For example, the 'omega' rocking curve for 0002 reflection gives full-widths at half maximum (FWHMs) of 1.7°, 1.3° and 0.4° (1430arcsecs) for 115nm AlN, 80nm ZrN and 860nm GaN stacks, respectively. By comparison, commercial GaN-on-sapphire has FWHMs of a few hundreds of arcseconds (100arcsec=0.025°).

The Purdue team comments that their results open the way to cost reduction and the scale-up of discrete LEDs and integrated LED arrays with back reflectors, but challenges remain. One is the 35% difference in thermal expansion between the GaN layer and the Si substrate. This leads to cracking as the stack is cooled when the GaN layer is greater than 1000nm. Another problem is that the GaN layer on top of the ZrN/AlN/Si shows a high threading dislocation density.

"These are engineering issues, not major show stoppers," says professor Timothy D. Sands. "The major obstacle was to devise a substrate based on silicon that also has a reflective surface beneath the epitaxial GaN layer; we have now solved this problem." Sands sees affordable white LED lighting being available within two years.

https://engineering.purdue.edu/HetInt

Emerging Standardization for Sapphire Substrate Inspection

By Frank Burkeen

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KLA-Tencor
Accelerating Yield®

The HBLED industry continues to thrive driven by market demand from mobile devices, automobiles, computer screens, and niche exterior and interior lighting applications. As HBLED device technology evolves and fabrication techniques become more advanced, defect detection and process control are critical to improving device yields. Sapphire substrate contaminants such as particles, scratches, pits, bumps, stains and residues from CMP processing are known to impact subsequent epi deposition processes and substantially degrade device performance and yield. As such, the need for higher quality sapphire substrates is of critical concern for HBLED device manufacturers.

The adoption of optical surface analyzer (OSA) technology is gaining momentum for use in HBLED manufacturing, specifically sapphire substrate inspection.

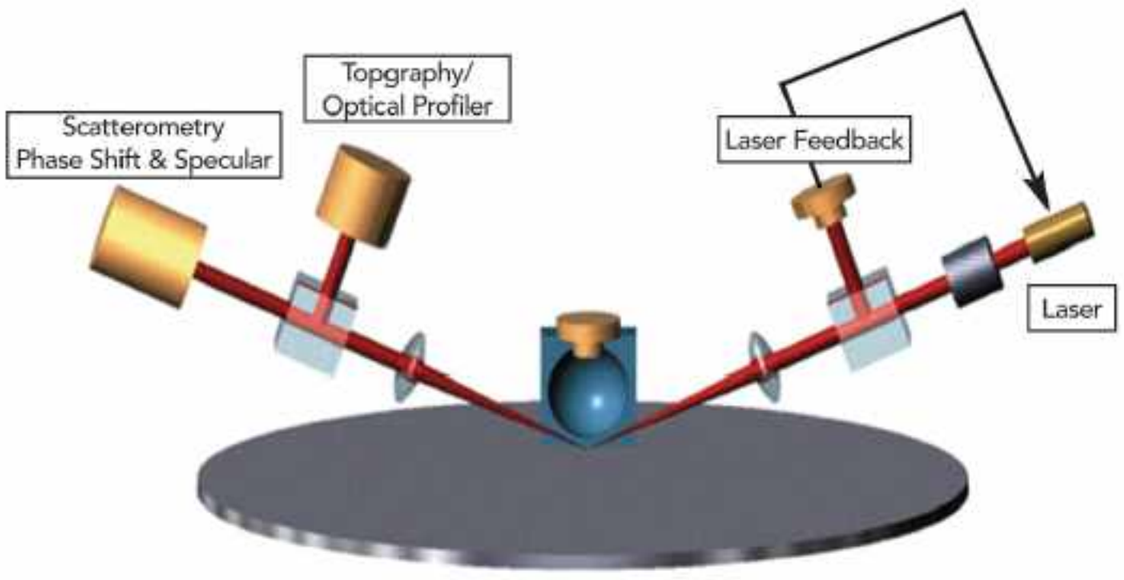


Figure 1: OSA technology combines four signal detection channels, enabling a wide range of inspection applications.

The design of OSA technology combines reflectometry, optical profilometry, scatterometry, and phase shift to measure topographic variations and detect a wide variety of surface defects. The inspection method achieves full surface coverage in minutes to produce high-resolution imaging, wafers maps, and automated defect classification.

At a throughput exceeding 40wph, an OSA system is the only wafer inspection method amenable to volume production and capable of advanced inspection of transparent sapphire substrates. Other inspection tools based solely on scatterometry cannot effectively measure transparent materials due to scattered light interference from the backside of the substrate. An OSA system is designed specifically for defect detection and classification of transparent materials including sapphire, GaN, SiC, and glass.

Figure 2 illustrates a sapphire substrate defect map after OSA inspection. Particles, scratches, pits, and stains are detected and classified in user-defined bins. The defect traceback images show a scratch as detected in the topography channel and two different types of stains as detected in the phase channel.

Scratches are known to transfer to the subsequent epi layer thereby degrading or killing device performance. Substrate stains have been reported to cause poor epi layer adhesion or result in rough epi morphology.

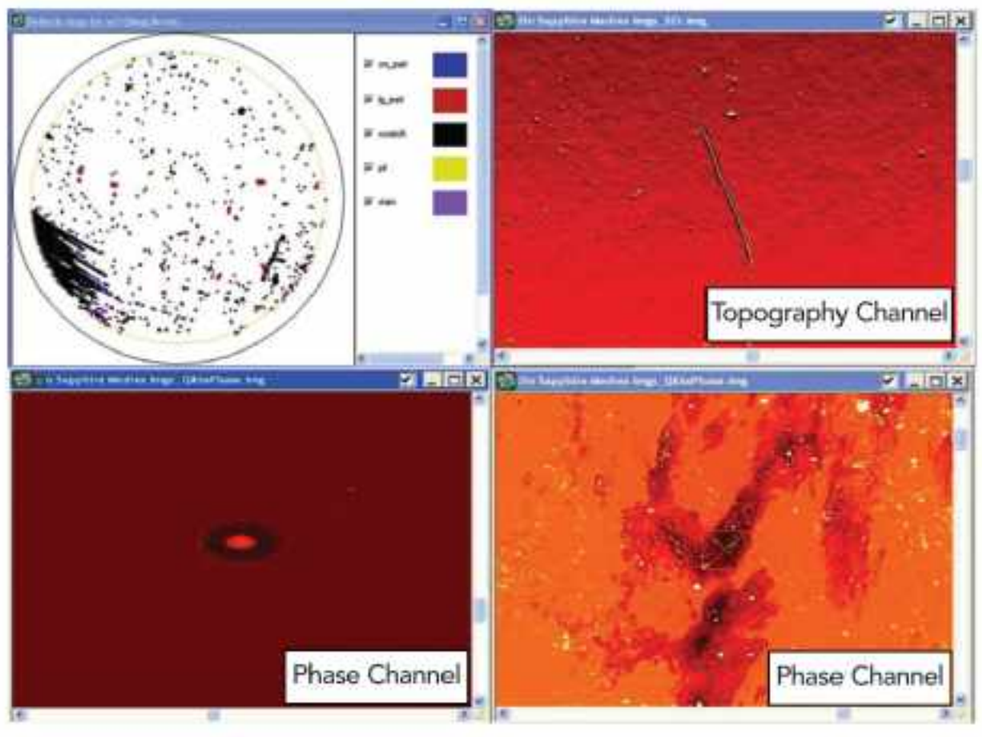


Figure 2: KLA-Tencor's Candela™ OSA defect map and traceback images of scratches and stains as detected in topography and phase channels, respectively.

As HBLED competition tightens and margins are squeezed, manufacturers are relying more on automated OSA inspection technology for process control and yield improvement. The emergence of sapphire substrate reclaim is also driving the need for advanced automated inspection. As supply is strained and material costs rise, the sapphire reclaim business is becoming more prevalent — whether for captive consumption or merchant supply. The reclaim business is even more dependant on OSA inspection as reworked material is highly susceptible to yield impacting defects.

Optical surface analyzer technology is setting the benchmark for automated inspection of sapphire substrates, and is emerging as the industry standard for overall sapphire quality control. HBLED device manufacturers and sapphire substrate suppliers are together converging on OSA inspection specs for quality assurance. Moreover, manufacturer's utilizing OSA technology are the beneficiaries of higher quality sapphire substrates passing distinct inspection specs.

Optical surface analysis technology enables manufacturers and suppliers to automate defect inspection and define objective-controlled process control limits. OSA technology can be employed at incoming substrate inspection, post-clean inspection, and after epi and film deposition processes.

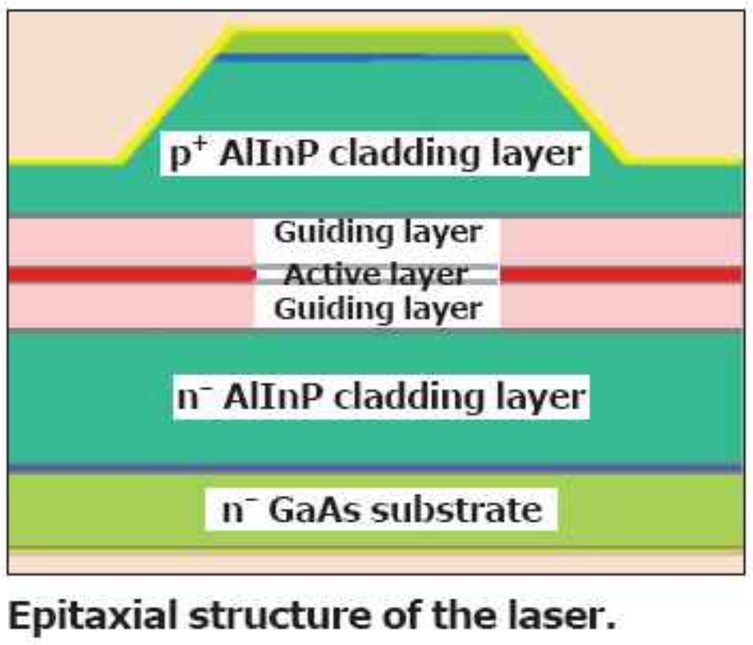
To learn more, go to:
www.kla-tencor.com/candela

Sony claims record-power 7.2W 635nm red laser array

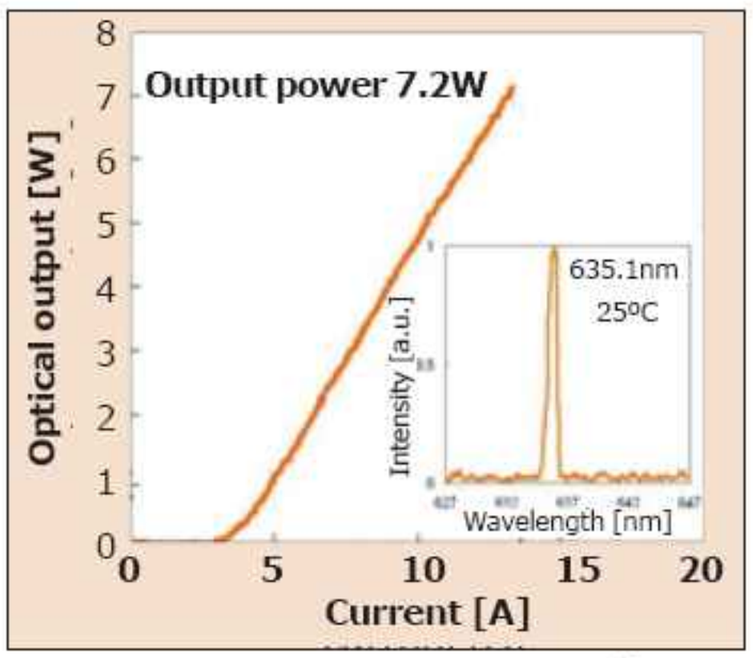
At the 69th Autumn Meeting of the Japan Society of Applied Physics at Chubu University in Nagoya, Japan in September, Sony presented the development of a high-power, short-wavelength red laser array diode incorporating a 2.5cm heat sink, making it suitable for use as a light source in projection devices.

For red semiconductor laser array diodes to be used in projection devices, they need to deliver high brightness, high efficiency and room temperature operation. The laser array diode achieves an oscillation wavelength of 635nm, generating brightness levels 1.6 times that of conventional 645nm red semiconductor laser arrays (developed by Sony in 2005).

The laser array consists of 25 broad-stripe lasers. The laser bars are 10mm long each and mounted on a copper heat-sink block. Sony says that it has achieved optimum uniformity within the laser active layer, high crystal purification levels, and a high concentration of magnesium doping within the AlInP cladding layer to realize low threshold currents and improved laser characteristics. Also, by introducing new die bonding technologies for attaching the laser array and heat sink, Sony says that it has enabled high levels of heat dissipation from the laser array. Furthermore, the accuracy of the laser bar mounting process has been improved to provide enhanced coupling efficiency between the laser array and the optical devices.



Epitaxial structure of the laser.



Output vs current; intensity vs λ.

As a result of these developments, the new red laser array combines a wavelength of 635nm, optical power of 7.2W, energy conversion efficiency (wall-plug efficiency) of 23%, and operation within 25°C room-temperature conditions. Low heat generation due to the laser array's high energy conversion efficiency means that only a small cooling system is required. The operating current is 14A and the operating voltage is 2.2V.

The heat dissipation and optical features enable the laser to be incorporated easily into the design of projection devices, Sony says.

www.sony.net

Bookham launches 20W single-emitter-based pump laser module for fiber-laser applications

Bookham Inc of San Jose, CA, USA has launched a single-emitter-based pump laser module capable of delivering 20W of fiber-coupled power into a 105μm-diameter fiber with a numerical aperture (NA) of 0.15.

Designed to target fiber-laser and direct systems for material processing applications, the increased power output enables users to generate greater power levels for fiber-laser pumping with fewer modules, allowing more compact pump configurations, greater pump block efficiency, and simplification of packaging, says Bookham.

The passively cooled, small-form-factor multimode pump module has a floating anode/cathode design and includes Bookham's latest generation of multimode pump laser chips from its facility in Zurich, Switzerland. The robust coupling approach delivers more than 80% coupling efficiency, and the module can operate at wavelengths of 795–980nm, suiting a variety of pumping and direct applications. The module is designed to include both current- and next-generation single-emitter laser chips, allowing seamless system upgrades.

Bookham's 20W pump laser for fiber-laser applications.

"As we see new entrants into the already highly competitive fiber-laser marketplace, cost will be an increasingly important factor for differentiation and the dollar per watt ratio is the key metric for all manufacturers," says Gunnar Stolze, director of High Power Laser marketing & sales. "With this increased power offering, we are enabling manufacturers who do not have their own internal pump laser diode technology to compete on both performance and price."

www.bookham.com

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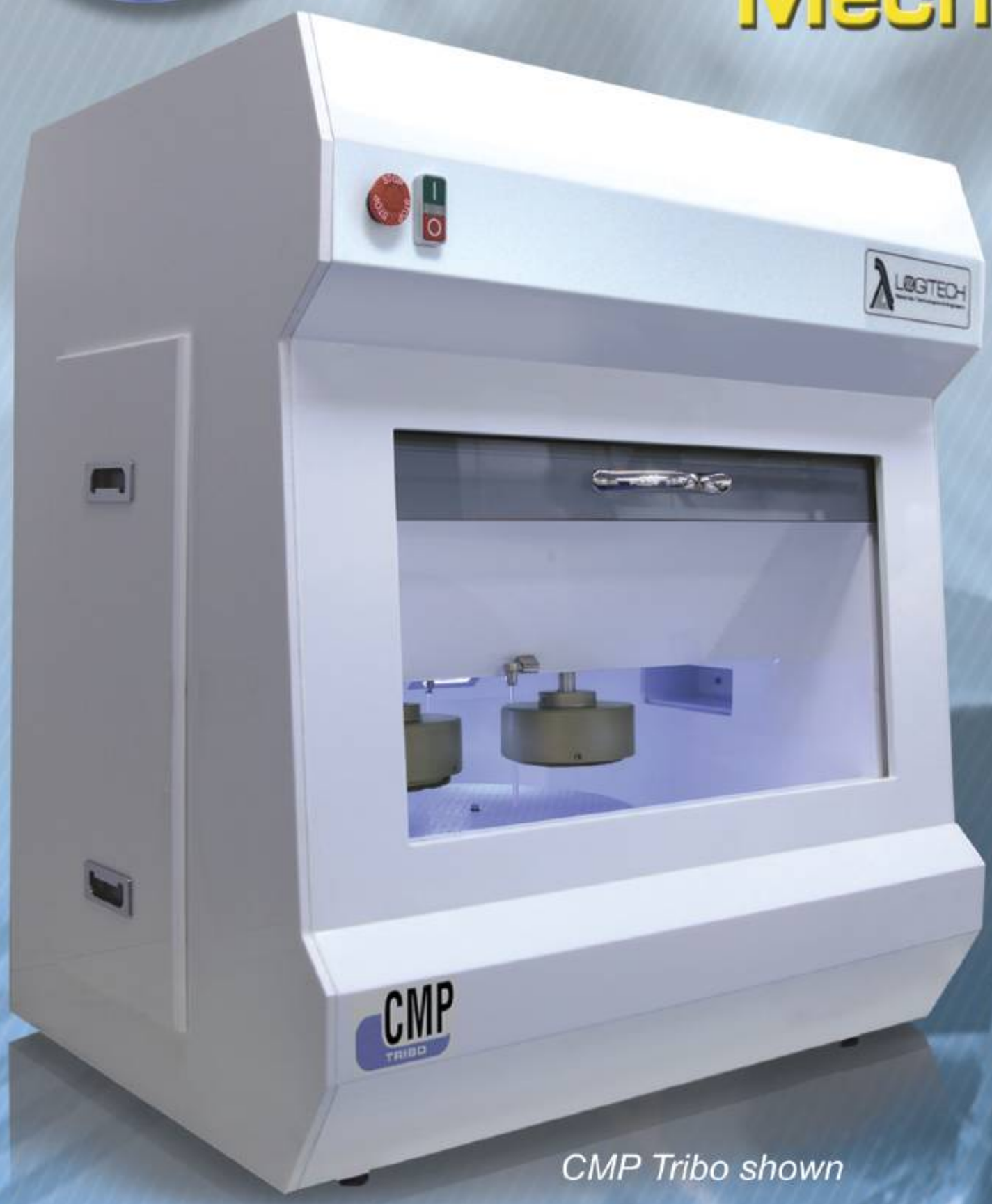

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IN BRIEF

QPC's green laser order for digital office equipment

QPC Lasers has received an order from an undisclosed 'global leader in digital information equipment' (copiers, scanners, printers, projectors etc) including customized green laser design and delivery for use in the development of a commercial laser projector.

Leveraging its green laser technology, QPC has received over $15m in new orders for its visible lasers since the first demonstration of its visible laser technology in September 2007. The firm has also recently received initial product orders from several other major consumer electronics companies. QPC believes that these initial orders could result in further, larger-size orders.

"Green lasers are the most challenging laser color to produce for commercial projectors because of unique and demanding performance and cost requirements," says VP of marketing & sales Paul Rudy. "Our green laser technology can enable higher-brightness displays with substantially reduced power consumption and attractive costs compared to other green lasers commercially available in the past," he reckons. "Our vision is to produce world-leading green lasers, as well red and blue lasers for laser display applications from 10 lumens to tens of thousands of lumens."

QPC says that its visible laser technology offers display makers high-speed modulation and highly efficient operation with minimal power consumption from a cost-effective, high-volume design. Its lasers are already being used to develop high-definition laser TVs, 3D projectors, handheld micro-projectors (pico-projectors) as well as other potential display applications.

www.QPClasers.com

Intense launches high-power, 905nm short-pulsed laser in rugged package

Laser manufacturer Intense Ltd of Glasgow, Scotland, UK has launched the Series 2675 Epi-Stack, a high-power, 905nm short-pulsed diode laser capable of up to 75W of peak power from a small 200µm x 10µm aperture.

The Series 2675 consists of a single, monolithic chip with three high-efficiency, epitaxially grown emitters, enclosed in a rugged, hermetically sealed 5.6mm (TO56) package. The firm says that this provides a cost-effective and reliable solution for integrators that need to simplify system design with reduced component count and lower cost.

The Epi-Stack is designed for low duty-cycle operation, typically 200ns, 2kHz, at operating temperatures of –40°C to +85°C. No thermo-electric (TE) cooling is required. The lasers are designed for aerospace, defense, and industrial applications that require ultra-high power from a small emitter area, such as LiDAR (light detection and ranging), range finding, geoscanning-mapping, ceilometers, and weapons simulation.

Intense's Series 2675 Epi-Stack 905nm short-pulsed laser.

"Developed in direct response to defense and industrial market requirements for more rugged and compact short-pulse monolithic arrays, the Series 2675 Epi-Stack builds on Intense's line of high-power pulsed laser diode offerings," says Kevin Laughlin, VP HPL global business development. "The compact, hermetically sealed, 5.6mm package makes this device ideal for most military and industrial applications where shock, vibration, and exposure to extreme environments are a concern."

Other packages are also available.

www.intenseco.com

nLight buys stake in Optotools

nLight Corp of Vancouver, WA, USA, which manufactures high-power diode lasers and fibers for military, industrial, medical, and consumer applications, has acquired a majority stake in Optotools GmbH of Heilbronn, Germany, which was established in 2001 and makes fiber-coupled high-power semiconductor lasers for industrial applications.

"This acquisition further enhances our portfolio of products for the industrial laser market", says nLight's president & CEO Scott Keeney. nLight raised its profile in the fiber-laser market in late 2007 by acquiring optical-fiber manufacturer Liekki Corp of Lohja, Finland.

nLight says that the Optotools product line will remain and that new, integrated products will be added in the next 12 months. Zukunftsfonds Heilbronn GmbH & Co KG (ZFHN) will remain as an investor and business partner, and Frank Pfeffer will continue as managing director of Optotools.

The firms will leverage mutual capabilities to continue expanding business in industrial lasers, says Pfeffer. "The market for high-power semiconductor lasers continues to grow," he adds. "To deliver the best technical solutions and superior support for industrial customers, it is critical to integrate all core competences."

www.nlight.net
www.optotools.de

QPC seeks partners while awaiting consumer ramp-up

For Q2/2008, QPC Lasers Inc of Sylmar, CA, USA, which makes high-power lasers for the consumer electronics, industrial, defense, and medical markets, has reported revenue of $1.3m, down from $1.6m last quarter and $1.8m a year ago. Operating loss rose from $1.6m a year ago and $3.3m last quarter to $3.5m. Cash reserves have fallen from $6.4m at the end of 2007 to just $463,000 at the end of June.

"Opportunities in the consumer and medical markets position us for growth over the next two years," says CFO George Lintz, citing two main consumer electronics deals: a $12m contract from Taiwan-based Asia Optical Co Inc (AOCI) for laser TV applications (announced last November) which is expected to ramp into production later this summer (with a potential value of up to $230m over its ten-year term); and an initial $3.5m red-green-blue laser contract from a US video gaming customer for 3D laser projection (announced in July, to enable the customer to seed the market prior to a full-scale production ramp-up). These orders represent very large potential new contracts, says QPC.

"Rapid acceptance of our technology by the consumer electronics market is reflected by our record pipeline of over $14m in signed contracts, which we expect to continue growing based on the number of new customer inquiries we are receiving," says CEO Dr Jeffrey Ungar. "The production phases of our existing contracts are paced by our customers' product roll-out schedules, and we have not yet realized the full revenue stream available from these contracts," he adds. Revenues for the first 6 months were not significantly changed from last year, but QPC expects this to improve as customers move products to market.

"We continue to make progress in our discussions with a number of potential strategic partners which, if successful, could provide us with the capital, industry expertise and other key resources to help us accelerate growth," says Lintz.

QPC lists progress towards gaining market share for semiconductor-based laser technology including:

- three new orders for engineering samples from major multi-national consumer electronics firms;
- shipping a 500W BrightLase Ultra-500 laser in June to a North American industrial customer for plastics and materials processing;
- demonstrating a miniature 1" x 1" integrated RGB laser for miniature laser projectors.

"We are particularly pleased to see some of the new and emerging applications of our Generation III technology; our lasers are now enabling more environmentally friendly metals and plastics processing, enhanced MRI medical imaging and new late-stage cancer treatments and surgical applications," continues Ungar.

"We expect our consumer electronics and medical business segments to continue to be strong growth drivers for us over the next two years as the market continues the adoption of laser solutions and as our customers begin ramping into production," says Ungar. "To ensure we are able to fully capitalize on this unique opportunity, we have retained two separate financial advisors [international and domestic] to assist in exploring various strategic opportunities available to us [to speed the capture of market share]."

Lintz adds: "We have also taken aggressive steps in reducing our expenses by over $150,000 per month [by restructuring the workforce and overhead costs] as part of our ongoing cost-management efforts designed to improve our financial footing and to take QPC one step closer towards our target of cash-flow breakeven in 2009".

Laser TV customer Asia Optical demonstrates 60" RPTV display

QPC says the customer involved in its $12m laser TV development and production contract (announced last November) is Taiwan-based Asia Optical Co Inc (AOCI), a maker of optical consumer electronics that was founded in 1981 and has annual sales exceeding $1bn.

AOCI has also now demonstrated a 60-inch image based on rear-view projection television (RPTV) laser technology at QPC's base in Sylmar.

QPC demonstrated its first green laser (based on frequency doubling of its proprietary BrightLase single-mode laser technology) just last September, and entered the visible laser market late last year. The AOCI contract is an exclusive supply relationship that provides for an $11m supply agreement to be delivered over the next three years.

The contract's development phase was completed on 7 July. "Less than eight months later [after agreeing the contract], we have delivered our lasers to spec and Asia Optical has already demonstrated a very large and impressive first image," says co-founder and CEO Dr Jeffrey Ungar. "This achievement is a testament to AOCI's engineering team, our next-generation technology, and our combined synergies."

QPC says that its BrightLase red-green-blue (RGB) lasers are designed for low-cost high-volume manufacturing and offer advantages to consumer electronics manufacturers including expanded color gamut, low power consumption and an ultra-compact footprint. QPC offers integrated visible laser technologies designed to be compatible with leading micro-display technology, including liquid crystal on silicon (LCOS), scanning micro-mirrors, digital light processing (DLP) and liquid crystal display (LCD) technology.

www.asia-optical.com

Firecomms appoints U.S. Opto Rep for Southern California, Arizona and Nevada

Firecomms Ltd of Cork, Ireland, which manufactures high-speed plastic optical fiber (POF) transceivers and visible vertical-cavity surface-emitting lasers (VCSELs), has signed a representative agreement with U.S. Opto Rep covering Southern California, Arizona and Nevada. Based in Simi Valley, U.S. Opto Rep will market and sell Firecomms' full range of POF transceivers, which are being adopted by developers of equipment for the consumer electronics, industrial and automotive networks.

"This agreement enables Firecomms to leverage U.S. Opto Rep's expertise in the sizeable California high-tech market," says Lawrence Thorne, VP of sales & marketing for the Americas. "With offices throughout California, U.S. Opto Rep is well-positioned to expand and support our customer base," he adds.

"We are seeing tremendous growth in the commercial, military and medical OEM optoelectronics markets," says U.S. Opto Rep's president Dennis Mattock. "Our goal is to 'design-in' lower-cost POF media solutions and Firecomms components into high-speed, more demanding home and commercial networks," he adds. "Firecomms components also provide the potential for weight reduction in commercial and military aircraft and aerospace communication applications."

Due to its ease of use, large core tolerances, and low costs, POF is growing in many applications. Created for consumer, commercial, industrial and automotive applications in which it can be used more easily and at lower cost than copper or glass fiber, POF is now used in millions of small-area networks (e.g. in many models of car) and is rapidly gaining ground in home network and point-to-point interconnection.

www.firecomms.com

Advanced Photonix grows 47% sequentially to record sales of $7.8m

For its fiscal Q1/2009 (end 27 June 2008), Advanced Photonix Inc of Ann Arbor, MI, USA has reported sales of $7.8m, up 47% on $5.3m last quarter. Growth was led by the telecoms sector, reflecting the production ramp of 40Gb/s client-side receivers, driven by carriers' capacity expansions in the long-haul transport portion of their infrastructure.

Products of the vertically integrated optoelectronics manufacturer include patented silicon, InP- and GaAs-based APD, PIN, and FILTRODE photodetectors; high-speed optical receivers; and the T-Ray 2000 and QA1000 THz terahertz instrumentation platforms.

Gross margin has risen to 48% from 34% last quarter, due mainly to increased military and telecom revenues, along with lower costs from wafer fab consolidation and closure of the assembly facility in Dodgeville, WI. Net income has improved to $147,000 from a net loss of $3.1m last quarter.

"Our high-speed optical receiver 40Gb/s products are starting to meet our growth projections, and we expect this to continue on an accelerated basis for the next several years," says chairman and CEO Richard Kurtz. "Our Optosolutions product platform provided strong revenue from the military and industrial markets, which helped to offset the decline in our medical revenues," he adds.

"We believe the growth in broadband applications and non-destructive testing markets will drive growth in our business now and in the foreseeable future," Kurtz says. "We are cautious due to the overall health of the economy and expect to continue to see fluctuations in customer spending in any given quarter due primarily to their new product introduction patterns," he adds. But even with this backdrop, Advanced Photonix is increasing its guidance for fiscal 2009 revenue growth (given at the end of June) from 25% to 30%.

www.advancedphotonix.com

SEI samples coaxial laser diode for high-bandwidth wireless applications

Sumitomo Electric Industries Ltd is sampling a new coaxial laser diode module capable of supporting high-frequency bandwidth applications (for sale by the end of 2008).

SEI's family of coaxial laser diode modules can now support a broader frequency range of 2–5GHz. The modules can be used in mobile base-station communication systems.

Currently, bandwidth requirements are increasing due to two factors: growing demand for upgrading existing communications systems, e.g. upgrade to digital CWDM; and the emergence of new applications, including WiMAX. SEI says that the new coaxial laser diode module is capable of supporting such upgrades and new wireless applications.

WiMAX supports three frequency bands (2.5, 3.5 and 5.8GHz), as defined in the IEEE 802.16-2004 specifications. The new module can support both the 3.5 and 5.8GHz bands.

One of its key features is its capability to achieve a 5GHz bandwidth. The firm says that its experience with various assembly and packaging techniques for a variety of modules such as 10Gb/s (transmission optical sub-assembly) has enabled it to develop a high-frequency diode for new mobile applications. As a result of redesigning the built-in isolator, there is an improvement in reflection as well as a reduction of parasitic capacitance.

www.sei.co.jp

Innolume raises €8.6m to boost quantum dot laser production

Innolume of Dortmund, Germany and Santa Clara, CA, USA, which manufactures quantum-dot (QD) laser diodes and modules operating at 1.05–1.32μm, has raised €8.6m in a Series C round of financing led by S-Group Capital Management Ltd (SGCM), joined by Applied Ventures LLC as a new investor, as well as existing investors NRW.BANK (the development bank of North Rhine-Westphalia), PEPPERMINT Financial Partners, S-VentureCapital Dortmund, Robert A. Young, and Juergen Kurb.

Innolume aims to use the funding to enhance its production capabilities and marketing activities (to sustain revenue growth from quantum dot laser products for telecom, industrial and medical applications) as well as for further development of its comb-laser and related photonic integrated circuits, in cooperation with top-tier semiconductor firms.

Innolume's comb source is a single laser diode that can provide hundreds of stable lasing lines for wavelength division multiplexing (WDM) optical interconnects in computer applications.

"The race is on to reduce the cost of optical solutions for short-reach interconnects to the level needed by high-volume, mainstream computing applications," says CEO Juergen Kurb. "Our vision is to enable high-density, low-cost WDM transmission by using a single light source for all wavelengths," he adds. "This funding will also enable Innolume to rapidly introduce to the market novel quantum dot based devices aimed at specific high-value medical applications."

SGCM partner Ilia Dubinsky stresses that, since the computer industry has recently committed to merging silicon computing technology with laser-powered optical interconnects, Innolume is applying the silicon integration paradigm (i.e. increased functionality and higher performance at lower cost) to quantum dot lasers for the first time. "This investment fits our model of identifying true innovators that have the potential to materially impact existing or emerging markets," Dubinsky says.

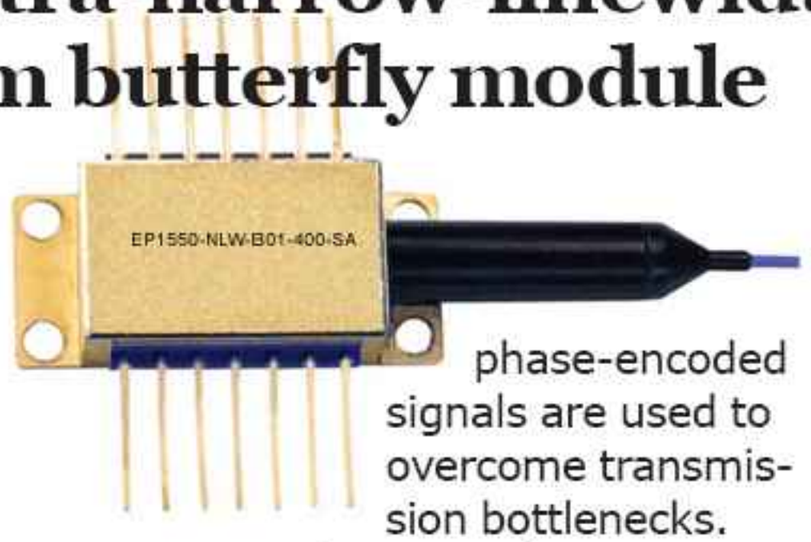
"Over the last years Innolume has clearly shown their capability to enable new, fast-growing applications with its unique technology," adds Peter Guellmann, head of NRW.BANK's venture investment department.

The Series C round follows 2003's €4.4m Series A round (led by PolyTechnos Venture Partners) and 2006's €6.5m Series B round (led by NRW.BANK), before a change of name from NL Nanosemiconductor GmbH to Innolume in January 2007.

www.innolume.com

Eblana extends ultra-narrow-linewidth laser portfolio to 400kHz 1550nm butterfly module

Eblana Photonics Ltd of Dublin, Ireland says that it has completed development of its EP1550-NLW-B Narrow Linewidth laser series and has begun commercial shipments. The latest series complements the firm's existing product portfolio for applications such as Gigabit and Gigabit Ethernet passive optical networks (GPON and GEPON), cable TV (CATV) and SONET/SDH.



EP1550-NLW-B series lasers have guaranteed emission line-widths specified at 400kHz and below, with highly linear light current characteristics and high side-mode suppression ratio (SMSR). The products are already being used in high-bandwidth coherent communications applications where, for example, high-spectral-efficiency, phase-encoded signals are used to overcome transmission bottlenecks. Devices are being used in various sensor, medical and imaging applications.

The laser is supplied in an industry-standard hermetically sealed 14-pin butterfly integrated with optical isolator, thermo-electric cooler (TEC), thermistor and power monitor photodiode. Each device is shipped with individual test data of the measured linewidth.

Eblana says that its proprietary laser technology is the key to achieving the product's unique features, which include mode-hop-free wavelength tuning by varying the bias current and/or temperature, and what the firm claims to be excellent wavelength stability.

"A key impact of our technology on the product's performance is that the laser emits in an ultra-narrow line even at low emitted powers, unlike DFB [distributed feedback] lasers which have to be driven at extreme operating points to achieve even MHz line-widths," says founder James O'Gorman.

"This product family extends our applications reach," says Dr Bo Cai, VP of sales & business development, adding that "feedback from first users of the EP1550-NLW-B has been extremely positive".

www.eblanaphotonics.com

HELIOS hybrid photonics project granted €8.5m

The European Commission (EC) has granted €8.5m ($12m) of funding to the four-year project HELIOS (pHotonics ELectronics functional Integration on CMOS) to support its aim of finding an innovative way to use microelectronics fabrication processes to combine a compound semiconductor photonic layer with CMOS silicon circuitry.

As a project within the Information and Communication Technologies (ICT) theme of the EC's 7th Framework Programme (FP7), HELIOS began in May and collects together 19 European partners: project coordinator CEA-LETI as well as CNRS, Alcatel Thales III-V lab, Thales, University of Paris-Sud, 3S Photonics and Photline Technologies in France, IMEC in Belgium, Phoenix BV in The Netherlands, IHP and the University of Berlin in Germany, Austriamicrosystems AG and the University of Vienna in Austria, IMM and the University of Trento in Italy, the University of Valencia, the University of Barcelona and DAS Photonics in Spain, and the University of Surrey in the UK. The overall cost of the HELIOS project is €12m.

CMOS photonics is being pursued as a way to improve a system's performance while also reducing size and cost in a range of applications, such as optical communications, optical interconnections between chips and circuit boards, optical signal processing, optical sensing, and biological applications.

Previous research projects have demonstrated basic CMOS photonics building blocks (a micro-laser, a detector, coupler and link). As the next step in the process, HELIOS proposes to integrate photonics components with ICs to enable an integrated design and fabrication method that can be used by EU-based manufacturers.

The project's objectives include:

- developing high-performance generic building blocks for a broad range of applications (e.g. WDM sources via heterogeneous integration of III-Vs and silicon, fast modulators and detectors, passive circuits and packaging);
- building and optimizing a complete production chain for fabricating complex functional devices that integrate electronics and photonics in a single chip (to be addressed not only at the process level but also by developing an adequate design environment);
- demonstrating the power of this production chain by fabricating complex photonic ICs addressing different needs (including a 40Gb/s modulator, a 10x10Gb/s transceiver, a photonic QAM-10Gb/s wireless transmission system, and a mixed analog and digital transceiver module for multifunction antennas).
- investigating some more promising, but challenging, alternative approaches, such as silicon lasers and amorphous silicon modulators, which offer CMOS integration advantages for the next generation of CMOS photonic ICs;
- roadmapping, dissemination and training, to strengthen European research and industry and to raise awareness of CMOS photonics.

The project's overall aim is to make CMOS photonics integration technologies accessible to a broad range of users via a foundry-like, fabless approach so that, long term, IC manufacturers can use photonics libraries and IP blocks and integrate them into their circuit designs.

www.helios-project.eu

OIF 100G project to focus on integrated photonics

With a record number of members in attendance, at its third-quarter meeting in Montreal, Canada the Optical Internetworking Forum (OIF) outlined details for its 100G long-distance dense wavelength division multiplexing (DWDM) transmission project.

During the joint session, carriers, along with system and component vendors, identified dual-polarization quadrature phase shift keying (DP-QPSK) as a modulation technique for integrated photonic components. With a number of possibilities available for use at 100G, identifying a specific modulation technique gives the industry a starting point to design hardware and reduce development risk, says the OIF.

"We have selected an implementation approach supported by a critical mass of photonic component vendors and users," says IBM's David Stauffer, the Physical Link Layer (PLL) Working Group chair. "100G is an important development for the industry, and network element vendors have already begun work," he adds. "The goal of the project is to accelerate the adoption of 100G in long-distance DWDM transmission."

The project will specify an implementation agreement (IA) for integrated receive and transmit photonic component(s) for DP-QPSK. The IAs will define partitioning of photonics sub-components, the electrical and the optical interface. The aim is to create a foundation for multi-source agreements for transmit and receive photonic components.

Also at the Montreal meeting, the OIF announced that it has published a guideline document for signaling protocol interworking of ASON/GMPLS network domains.

"This document leverages the implementation experience of our members in recent interoperability demonstrations," says Alcatel-Lucent's Jim Jones, VP of marketing for the OIF. "It specifies interworking procedures for ASON- and GMPLS-based signaling solutions at domain boundaries and paves the way for end-to-end service provisioning, independent of the control plane solution within each domain."

www.oiforum.com

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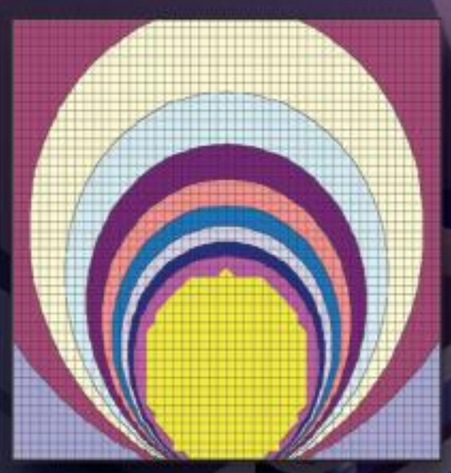

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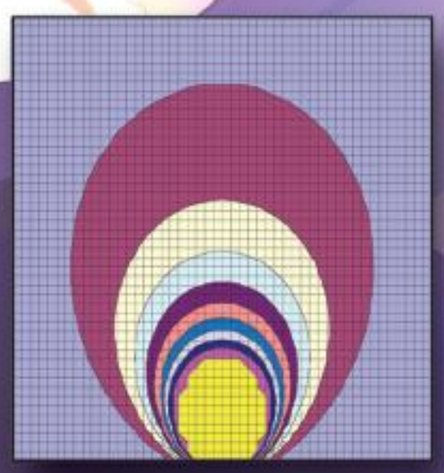

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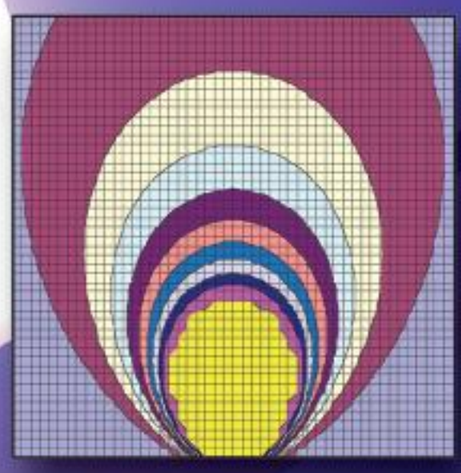

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Avanex's margins hit during new-product ramp

For its fiscal Q4/2008 (to end June), optical communications component and module maker Avanex Corp of Fremont, CA, USA has reported sales of $51.8m, rebounding by 5% from the low of $49.6m last quarter and up 1% on $51.1m a year ago. The recovery has been driven by an increase in transmission products sales plus $1.2m of deferred revenue after settling legal proceedings over a distribution agreement with former French subsidiary 3S Photonics.

North America comprised 43% of revenues, Europe 32% and Asia 25% (the latter up 30% on last quarter). Avanex's 10% customers were Alcatel (27%) and Tellabs (22%).

Avanex says it has re-categorized its product lines into three key areas (transmission, regeneration and wavelength management) to allow better tracking of progress as it strengthens its portfolio and expands into global markets.

Targeting the largest and fastest-growing market, transmission products (including transceivers, transponder and modulators) grew as much as 25% in Q4 to a third of revenues (and more than 50% of design wins). Drivers include the move to higher transmission rates (e.g. 40Gb/s) and new modulation format, longer-reach business. The firm also continues to see a trend to tunable components.

Regeneration products (including control amplifiers, gain blocks, dispersion compensation modules and integrated optical performance monitoring products) fell by 12% to about half of revenue (and 30% of design wins).

Wavelength-management products (including fixed- and reconfigurable-wavelength routing products) grew by 10% to about 15% of revenue (and more than 20% of design wins).

Gross margin was 32%, flat on last quarter but up from 24% a year ago. However, excluding benefits such as the 3S settlement, gross margin would have been lower by 5–6%. Non-GAAP net income was $1.6m, up from breakeven a year ago but down from last quarter's $2.9m.

For fiscal Q1/2009 (to end-September), Avanex expects gross margin to fall to 20–23% due to: lower revenue of $44–48m (mainly a result of market slowdown in Asia and pricing pressure); a temporary shift in product mix towards lower-margin legacy products (for which Avanex is aiming to reduce sales); a higher-than-expected double-digit decline in average selling price (ASP) for one of Avanex's highest-revenue products from one particular customer (for a legacy system); and investing in new capacity for key products such as reconfigurable add-drop multiplexing (ROADM) modules and tunable transponders (with R&D expenses also rising to address such growing markets).

After completing restructuring activities in fiscal 2008, in order to compete more effectively in the fastest-growing markets Avanex is replacing lower-margin legacy products by developing next-generation products (e.g. tunable transponders, tunable dispersion compensators and control amplifiers).

However, Giovanni Barbarossa (appointed interim CEO in early July) explains that the drops in margin and income are due to a combination of a delay in Avanex's ability to bring new products to market and delays in some customers being able to adapt to the new products. In particular, in the optical telecoms equipment industry, time-to-market is the key difference, the firm says.

Avanex is replacing lower-margin legacy products by developing next-generation products

Avanex's focus over the next few quarters is therefore to expand margins by improving execution in new product development (bringing products to market faster and at the right time) and strengthening relationships with key customers. Already, in fiscal Q4, Avanex extended its supply agreement with Alcatel–Lucent, and had a number of new design wins with multiple customers. Also, as part of its strategy to expand in high-growth regions, the firm increased its development sales and operation teams in Asia.

"We've been encouraged by our recent design wins and we see significant opportunities for our new products," says Barbarossa. "We see three or four new product lines coming in that could be very successful, including our tunable dispersion compensation line, WSS/ROADM area, and then also some of our new transmission products (including transponders)," adds VP of finance and interim CFO Mark Weinswig. "We need to invest in new capacity to increase revenue on the new products, especially with the higher-margin products," he adds.

"There is a considerable opportunity to increase revenue from transmission products as we leverage our next-generation products, including our new tunable transponder platforms and modulators," believes Barbarossa. "With the market moving to 40Gb/s deployment, new technologies to enable higher transmission rates are critical to meet growing bandwidth demand, so we see a significant opportunity for our regeneration products," he adds. "In particular, we saw increased traction with customers for new tunable dispersion compensation products, especially in next-generation submarine systems and 40G applications."

Capacity investment will continue for the next few quarters as Avanex ramps up new products, says Weinswig. Revenue for new products should help to expand margins.

For fiscal 2009, Avanex hence expects to see solid revenue growth (even after excluding the $10m generated from 3S in fiscal 2008) as well as profitability for the entire fiscal year. "Our model is to reach break-even at around $50m," says Barbarossa.

www.avanex.com

3S grows more-than-expected 87% in fiscal 2008

For fiscal 2008 (to end June), telecom laser chip and module maker 3S Photonics of Nozay (Essonne near Paris), France, a manufacturer of laser chips, optical discrete modules and components for telecom networks, has reported revenue of €27.9m (exceeding the forecast of €24–27m). This is up 87% on fiscal 2007's €14.9m (considering only the product portfolio after Alexandre Krivine and Didier Sauvage acquired what was Avanex France SA in April 2007 from Avanex Corp, which in 2003 had acquired what was then Alcatel Optronics).

3S attributes the increase to organic growth of almost 15% in the optoelectronics market, coupled with the firm's launch of innovative new products. Some products have been designed especially to meet the needs of the submarine communications market, which 3S says is currently booming. Sales of these highly strategic components - pump laser modules, filters based on fiber Bragg gratings (FBGs), and photo-detectors - grew three- or four-fold in fiscal 2008. The terrestrial pump laser module market has followed suit, with the launch of a complete line of 980nm-wavelength products contributing to growth, along with transmission laser modules.

This organic growth has been complemented by the launch of collaborative French and European R&D projects. During fiscal 2008, 3S won two major contracts: one with the French Ministry of Defense for the development of laser modules with high optical power and low noise; plus the '6_POD project', dedicated to the development of photonic integrated circuits (PICs) for broadband networks.

Fiscal 2008's operating income was €2.12m compared with fiscal 2007's loss of €7.03m. EBITDA (earnings before interest, taxes, depreciation, and amortization) reached €2.67m, versus a loss of €5.63m. Net income has nearly tripled from €0.75m to €2.08m.

Restructuring and cost-reduction, coupled with the significant organic growth, have helped 3S to quickly achieve its goal of returning to operating profitability, according to chairman & CEO Alexandre Krivine.

3S is expecting to increase revenue by about 20% in fiscal 2009, building on continued organic growth driven by renewal of the firm's product portfolio. "In the medium term, we plan to double our annual revenues through external growth operations," concludes Krivine.

www.3Sphotonics.com

JDSU launches first diode laser with fiber-laser power feedback protection

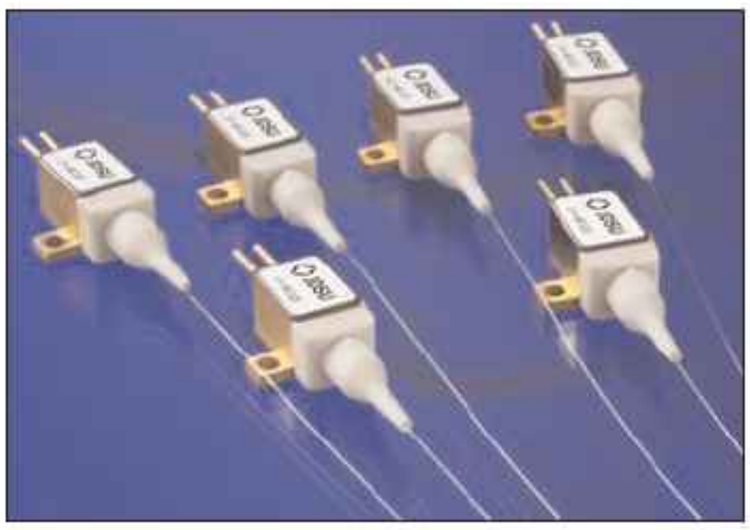
JDSU of Milpitas, CA, USA has launched the 6398-L4i series, an enhanced version of its most powerful fiber-coupled diode laser (and an extension of the telecom-grade L4).

Designed for industrial, medical and dental applications (including fiber-laser pumping and material processing), JDSU says the new product is the first of its kind to provide OEMs with a simple and cost-effective way to protect diodes from destructive power feedback during fiber-laser operation (replacing costly and complex isolation systems used to protect diode lasers).

JDSU has designed the L4i series as a simple solution to address this issue, while also providing high-performance capabilities, says Franck Leibreich, manager of High Power Diode Laser Marketing for JDSU's Optical Communications business segment.

Key features include:

- the highest output power available (10W), with a package that has the potential for future scalability;
- expanded 100µm fiber delivery at a numerical aperture (NA) of either 0.22 or 0.15;
- smaller, more efficient package (taking up less space than previous designs, allowing more units to be packed within a smaller area);
- new electrical format (simplified electrical design removes need for additional parts, easing integration into OEM systems);
- improved wavelength flexibility (available at 910–980nm).



JDSU's 6398 L4i series of diode lasers.

www.jdsu.com

U-L-M qualifies laser dicer for VCSELs

U-L-M Photonics in Germany has qualified and bought a laser dicing system from Advanced Laser dicing Separation International nv (ALSI) of Beuningen, The Netherlands.

U-L-M manufactures products such as single-mode vertical-cavity surface-emitting lasers (VCSELs) for computer mouse tracking systems and other VCSEL products for sensor and datacom applications.

ALSI's multibeam laser dicing technology is enabling U-L-M to significantly increase the wafer yield, die quality, and throughput time of the dicing process, says U-L-M's Dieter Wiedenmann, co-founder and manager of quality assurance.

ALSI's multibeam laser dicing concept has been used previously in the RFIC, LED and solar cell industries. VCSEL laser dicing uncovered new challenges for process development, but partnering with U-L-M resulted in rapid qualification, says René Hendriks, director of sales.

www.laserdicing.com

IN BRIEF

Bookham joins Russell 3000 index

Bookham has joined the Russell 3000 Index, which remains in place for one year and also means automatic inclusion in the small-cap Russell 2000 Index.

The Russell 3000 Index measures the performance of the 3000 largest US firms based on total market capitalization.

"This achievement is a direct reflection of the progress we have made in improving our financial performance the past year," says president and CEO Alain Couder. "We continue to believe Bookham's continued growth and improvements will result in positive cash flow from operations before the end of this calendar year and profitable growth over the long-term," Couder adds. "Inclusion in this index should increase Bookham's visibility with investors, and potentially lead to a broader shareholder base during a period when we expect our overall business to expand."

www.russell.com

Bookham losses narrow towards positive December-quarter cash flow

For its fiscal Q4/2008 (to 28 June), optical component, module and subsystem maker Bookham Inc of San Jose, CA, USA recorded its fifth consecutive quarter of sales growth, to $62.6m (up 39% on $45.1m a year ago and 5% on last quarter's $59.7m). This was also near the top of April's forecast of $58–63m.

Non-GAAP gross margin was 23%, flat on last quarter but up from 17% a year ago. Nevertheless, operating loss has been cut from $14m a year ago and $6.7m last quarter to $4.7m, and non-GAAP net loss has been cut from $10.8m a year ago and $3.4m last quarter to just $1.5m, while adjusted earnings before interest, taxes, depreciation and amortization (EBITDA) has improved from –$6m a year ago and –$1.1m last quarter to just –$0.7m. Cash, cash equivalents, short term investments and restricted cash fell from $54.7m to $51.9m during the quarter.

For full-year fiscal 2008, revenue was $235.5m, up 16% on fiscal 2007's $202.8m. Net loss was slashed from $82.2m to $23.4m, while adjusted EBITDA improved greatly from –$38.1m to –$3.9m.

"We are proud of our turnaround and our growth momentum," says president and CEO Alain Couder. "We continue to gain market share in tunable products. Also, our indium phosphide chip technology is rapidly becoming the preferred choice for tunable applications, in particular in 40Gb/s solutions. We plan to align our capital spending to fulfill increasing demand in these key growth markets," he adds.

For fiscal Q1/2009 (ending 27 September), excluding restructuring and other non-recurring charges, revenue should grow to $64–68m; non-GAAP gross margin of 22–26% (excluding stock compensation and one-time costs from the transfer of San Jose photonics operations to Shenzhen, China); and adjusted EBITDA of between –$2m and +$2m.

"We believe our non-GAAP operating income and our cash flow from operations, prior to any capital spending, will be positive in the December 2008 quarter," concludes Couder.

www.bookham.com

40Gb/s ODQPSK tunable transmitter demonstrated

At its facility in Caswell, UK, Bookham has completed tier-1 customer demonstrations of its 40Gb/s ODQPSK (optical differential quadrature phase shift keying) tunable transmitter capability, using cascaded dense wavelength division multiplexing (DWDM) nodes to reproduce real network conditions.

The tunable transmitter assembly (TTA) is designed to meet price points enabling cost-effective deployment of 40Gb/s transmission in metro networks, and will be sampled into customer premises in September.

The TTA is underpinned by a single gold box co-packaging an InP-based Mach Zehnder modulator measuring less than 10mm (believed to be the smallest 40Gb/s modulator) and the firm's LambdaFLEX DSDBR (digital supermode distributed Bragg reflector) tunable laser. The TTA, which implements all required control circuitry including an OIF standard tunable laser interface, is just 74mm x 39mm x 8.4mm, and the first building block towards Bookham's 40Gb/s transponder.

Bookham uses the ODQPSK modulation scheme for 40Gb/s. The firm says that InP technology is well suited for such formats, where integration of several modulators onto a single chip is a key enabler for space and cost reduction.

"These successful network simulation tests with our key customers are a big step forward for the Bookham 40Gb/s program, confirming the superior optical performance of ODQPSK modulation and its excellent adaptability to multiple fiber types," says PLM director Adam Price. "Through our vertical integration model we are proving that InP technology established by Bookham can provide the high performance needed for line-side 40Gb/s optical networks, without the cost, power and size issues linked to less integrated transmitter and decoder solutions," he adds. "This performance is targeted to be delivered at a price point that will see us create a real market for 40Gb/s in the metro/regional network, in line with service providers requirements," he reckons.

www.bookham.com

Supply and capacity constraints suppress JDSU's profits

For its fiscal Q4/2008 (ended 28 June), JDSU of Milpitas, CA, USA has reported revenue of $390.6m (44% Test & Measurement; 37% Optical Communications; 13% Advanced Optical Technologies; 6% Commercial Lasers). This is up 11.3% on $350.7m a year ago and 1.7% on last quarter's $384.2m.

Growth was driven by Optical Communications revenue rising for a fourth successive quarter to $145.1m (up 6.6% on Q3's $136.1m and up 33% year-on-year), including sales from VCSEL-based transceiver maker Picolight (acquired in May 2007), since when JDSU has added three new VCSEL customers. "We continued to see favorable end-market indicators for broadband services and network build-outs," says CEO Kevin Kennedy.

However, growth in demand outpaced both supplier and production capacity ramp for several products (including tunables and ROADMs, which are starting to see wider acceptance outside North America) constraining growth.

Gross margin was 40.9%, up from 37.4% a year ago (with Optical Communications almost doubling) but down from last quarter's 42.6% due to the Test & Measurement product mix.

Net loss has risen from $17.9m a year ago to $29.8m, due mainly to non-recurring charges of $45.4m from acquiring da Vinci Systems and American Banknote Holographics. However, excluding such charges, non-GAAP net income has risen slightly from $15m a year ago to $15.5m. JDSU was free cash flow positive for a sixth quarter in a row.

Compared to fiscal 2007, fiscal 2008 saw improvements in revenue (up 9.5% from $1.4bn to $1.53bn), gross margin (up from 37.7% to 42.8%), and non-GAAP net income (up from $64.1m to $114.9m).

Optical Communications revenue was $527m, up 6.2% on fiscal 2007's $496m. "We see broadband expanding, with spending focused on network build-out projects and investment in Ethernet, high-speed fiber and video deployment," says Kennedy. Despite cable network operator investment being flat, North America revenue grew 6%. "We saw growth of nearly 80% in Latin America, where greenfield build-outs are increasing. Europe has shown strength, growing at 16%; Asia increased by 12%, where we are seeing particular strength in India."

Optical Communications improved from an operating loss of 2.9% for fiscal 2007 to a profit of 3.9% (including 5.4% in Q4), reflecting the impact of higher revenue and lean manufacturing cost-reduction initiatives implemented over the past fiscal year, says Kennedy.

"Moving into 2009, we will continue to focus on advancing our business model across all of our business segments," Kennedy notes. "Our strategy continues to be to execute as a diversified technology company with a focus on optical and broadband innovation," adding that the composite company is better able to navigate fluctuations in any one constituent business. "We believe broadband capacity will continue to expand as higher data rates are being delivered to the access/edge, accompanied by video applications and high-definition network requirements," says Kennedy.

However, economic uncertainty in markets served by JDSU may result in fluctuations in demand over the next several quarters. "In North America telecom, we witnessed a pattern such that a few of the largest providers increased their spending while the smaller service providers evidenced cautionary practices," says Kennedy.

For fiscal Q1/2009 (ending 27 September 2008), JDSU expects revenue to be relatively flat at $378–394m, with non-GAAP operating margin of 3–6%. "We typically experience a seasonal slowdown in fiscal Q1, given European vacations," says Kennedy. But, in addition, Optical Communications product capacity continues to be constrained, so JDSU has had to re-schedule $10m of fiscal Q1 demand for shipment in Q2. However, the long-term annual growth potential for Optical Communications is 5–15%, fueled by telecoms transitioning to DWDM, JDSU reckons.

In fiscal 2008, JDSU moved towards achieving its model gross margins of 43–47% and operating margins at or above 10%. The goal is to achieve this on a sustainable basis by the end of calendar 2008 at a revenue level of $400m per quarter and gross margin of 46%. To improve operating margins by 3–5 percentage points for fiscal Q2/2009 and the reminder of the fiscal year, JDSU is hence taking additional steps to lower its cost structure (with staffing already having been cut from 6745 to 6695 in fiscal Q4), including more use of contract manufacturing in Test & Measurement and the transfer of Commercial Laser manufacturing to an Asian contract manufacturer.

Optical Communications product capacity continues to be constrained, so JDSU has had to re-schedule $10m of fiscal Q1 demand for shipment in Q2

- In mid-July, JDSU completed its $200m stock repurchase program (announced only in mid-May).

www.jdsu.com

Finisar and Optium hit record revenues prior to merger

For fiscal Q1/2009 (ended 3 August), Finisar Corp of Sunnyvale, CA, USA reported record revenue of $128.7m, up 21.7% on $105.7m a year ago, and exceeding the firm's guidance of $120–125m. Growth was driven by record revenues for both optical subsystems and network test systems.

Revenue from optics (fiber-optic components and subsystems) was $115.8m, up 20.1% on $96.4m a year ago. In particular, revenue from products for 10–40Gb/s applications was $32.2m, up 76.6% on $18.2m a year ago (due mostly to longer-reach applications).

Driven by a favorable product mix of optical subsystems (mostly due to higher-margin products for metro telecom applications) as well as revenues for network test (which has much higher gross margins than optics), gross margin has grown from 30.6% a year ago and 32.9% last quarter to 38.4%.

On a non-GAAP basis, net income was $11.6m, up on $3.7m last quarter and $7.9m a year ago.

Finisar's performance underscores the power of vertical integration combined with a leading market-share position, reckons executive chairman Jerry Rawls. The merger with optical subsystem maker Optium Corp of Horsham, PA, USA (completed on 29 August) will add additional momentum.

Finisar also reported that revenue for Optium's fiscal Q4/2008 (ended 2 August) was a record $47.2m, up 76.3% on $26.8m a year ago.

In particular, driven by record growth in pluggable and 300-pin tunables, 10–40Gb/s revenue grew 71% year-on-year (to 65% of total revenue), including 40Gb/s alone growing from $200,000 to $2.7m. Accelerated R&D investment (contributing to full production of DPSK 300-pin solutions) drove 40Gb/s to 6% of revenue (versus a 5% target). New products (e.g. small-form-factor tunables as well as new customer opportunities in pluggable optics) contributed to success.

Operating expenses rose from $7.7m to $11.5m, due mainly to ramping product introductions and capacity for the new reconfigurable optical add/drop multiplexer (ROADM) and 40Gb/s product lines. Despite this, operating income was $0.78m, an improvement on last quarter's loss of $1.4m. Gross margin of 25.7% is up from 23.5% a year ago.

"The addition of Optium's strong product lines directed toward high-growth markets such as ROADMs and 10–40Gb/s products for telecom applications, as well as a significant position in the cable TV market, will provide additional fuel to power the Finisar model," says Eitan Gertel, Finisar's new CEO (former chairman & CEO of Optium). These investments will provide Finisar with a powerful platform for capturing the high-growth trends in the optical communication markets, he reckons.

"Benefits of the merger with Optium are considerable, given our core strengths in enterprise storage and networking metro Ethernet combined with Optium's core strengths in long-haul telecom and CATV," says Rawls. "We now have one of the broadest product portfolios in the industry," he reckons. "The merger will also combine Finisar's vertically integrated low-cost manufacturing capabilities with Optium's mass customization expertise to create a formidable supplier with a broad range of capabilities."

Finisar foresees continued strong growth for 10–40Gb/s

Both Optium and Finisar are engaged in a large number of new product qualifications at many customers for both data center and telecom products, which should drive additional revenue growth. "While there may be pockets of slowness within telecoms, our completion of a number of new product qualifications and the ongoing penetration of fast-growing 10 and 40Gb/s markets should translate to an exciting period of growth through fiscal 2010 and beyond," believes Rawls. Qualifications include more than a dozen 10Gb/s products at 40 different customers, while the firm's latest generation of 40Gb/s client-side transponders are being qualified at nine different customers.

Finisar foresees continued strong growth for 10–40Gb/s applications, not only for next quarter but particularly in its fiscal second-half 2009 (from November). "Our customers are optimistic about the next several quarters... we expect our data center and telecom product sales to increase this fiscal year," forecasts Rawls.

"We also made significant progress in gaining new customers around the world, an effort that I believe is only at the early stages in terms of opportunity," says Gertel. "We expect activity with these new customers to continue to develop in the coming quarters and as we continue to leverage the strength of an even stronger product portfolio as a combined company," he adds.

For the upcoming quarter, Finisar expects combined revenues of $156–167m, including $145–155m from optics. Excluding about $35m from two months of Optium revenue, Finisar's optics revenue should hence be roughly flat on $115.8m, before growing once again in fiscal second-half 2009 (from November).

In the meantime, with Optium's gross margins initially lower than those of Finisar, combined gross margin should drop to about 36% in the upcoming quarter (fiscal Q2), especially since Optium's XFP product (for which revenue grew 30% sequentially last quarter) has the lowest gross margin of the firm's 10Gb/s portfolio. A benefit of the merger is being able to produce the XFP products the same way as Finisar and hence to improve the gross margin, says Gertel. The impact of such synergies on operating expenses should begin to kick in from fiscal Q3 in January, translating to net income of $11–12m.

www.finisar.com

PICs surpass 100 million hours of operation failure-free

Infinera Corp of Sunnyvale, CA, USA, a vertically integrated manufacturer of digital optical network systems, says that its InP-based photonic integrated circuits (PICs) have surpassed a cumulative total of 100 million hours of operation in live networks worldwide without any PIC failures. Also, Infinera has now shipped more than 10,000 dense wavelength division multiplexing (DWDM) line cards, representing more than 1 Petabit/second of network capacity.

Infinera's PICs integrate 60 devices, including lasers, modulators, photoreceivers and DWDM multiplexers onto a pair of monolithic chips with a total capacity per chip of 100Gb/s. The firm claims that the high level of integration enables its optical systems to deliver advantages in scalability, cost, space consumption, power consumption, and reliability. It adds that its PICs' high reliability has been achieved by an early and sustained focus on design for manufacturability and carrier-grade reliability — designing PICs that deliver network benefits while showing high quality and cost-effectiveness in volume manufacture. Test results show that Infinera's transmit PIC, with 50 optical devices, has equivalent reliability to that of many single active optical components currently deployed in networks. At the network level, the PICs deliver improvements in network reliability and ease of use by eliminating more than 90% of fiber couplings (a major source of problems and outages in traditional networks).

Infinera reckons that its highly reliable manufacturing process has also helped it to improve its wafer fab's efficiency 60-fold since volume manufacture began in 2004.

"It shows that photonic integrated circuits advance similarly to electronic integrated circuits, where silicon chips have been able to deliver very high quality while increasing complexity and functionality year after year, due to the learning curve in the manufacturing process," comments chief marketing and strategy officer Dave Welch. "Just as there is a silicon learning curve, we are discovering there is a photonic learning curve."

Earlier this year, Infinera unveiled plans for its next commercially produced PICs, with a data rate of 400–500Gb/s. These are expected to have more than 200 integrated optical devices on a single chip. The firm foresees that further technical progress will enable continued scaling in PIC capacity, enabling a doubling of capacity per chip every three years.

www.infinera.com

Infinera ships 1 Petabit of DWDM capacity

Infinera has announced that, since beginning commercial shipments in late 2004, it has now shipped more than 10,000 DLM line cards. This equates to 100,000 DWDM wavelength ports operating at 10Gb/s of capacity, or a total DWDM network capacity of 1Petabits per second.

According to analyst firm Dell'Oro Group, Infinera ranked first in unit shipments of 10Gb/s long-haul DWDM wavelengths, with a 44% share of wavelengths shipped worldwide in Q2/2008.

"Infinera's growth has been one of the fastest ramps in the history of the optical networking industry," claims CEO Jagdeep Singh, who adds that vertical integration is a key competitive advantage. "Photonic integration is such an important technology that we expect other companies to enter this market eventually, with solutions based on large-scale photonic integration." However, in the case of most competitors, not having a components business in-house makes it hard to develop photonic integration solutions, he reckons.

Interest in photonic integration continues to rise throughout the optical networking industry, says Infinera. At the 34th European Conference & Exhibition on Optical Communication (ECOC 2008), chief marketing and strategy officer Dave Welch spoke on the network-level benefits of photonic integration technology in a panel titled 'All-Optical versus OEO Networks'. On 25 September, Infinera's Brent Little presented a paper on the use of micro-ring resonators as tunable optical filters. On 7–8 October, Infinera executives are speaking at the conference 'Photonic Integration: The Path to the Optical Future' (sponsored by the Optoelectronics Industry Development Association). On 5 October, a panel discussion at the Optical Expo conference 'Photonic Integration: Redefining Optical Cost, Scale & Performance' is being hosted by optical industry analyst Sterling Perrin (who, in March, published the report 'Photonic Integration and the Future of Optical Networking', which singled out Infinera as having a four-year lead in the technology).

Not having a components business in-house makes it hard to develop photonic integration solutions

"Photonic integration is the industry's best hope for reducing the cost per bit in optical networks," says Perrin. "Operators will increasingly look to photonic integration as a way to build scalable, reliable, and cost-effective networks... this reliability milestone helps make the case for the long-term commercial viability of the PIC."

Oplink's earnings rebound as revenue falls less than expected

For its fiscal fourth-quarter 2008, optical networking component, module and subsystem maker Oplink Communications Inc of Fremont, CA, USA has reported revenue of $37.3m, flat on $37.2m a year ago and down 8.6% on last quarter's $40.8m.

However, this is slightly above May's guidance of $33–37m, which attributed the drop to continued reduced sales of reconfigurable optical add-drop multiplexers (ROADMs), softness in orders from Europe, and transferring the manufacturing of Optical Communication Products Inc (OCP) of Woodland Hills, CA, USA (acquired last year) to China, where Oplink has facilities in Zhuhai and Shanghai.

Net loss has been cut from $3.9m last quarter to just $791,000 (compared to net income of $3m a year ago). On a non-GAAP basis (excluding transitional costs for contract manufacturing and fees relating to the OCP merger), net income is up from $2.5m last quarter to $2.8m (though still down from $5.6m a year ago).

Cash, cash equivalents and investments rose from $138.3m to $142.1m during the quarter.

"We are pleased to report revenue slightly above the outlook we provided last quarter, improved gross margins and increased operating efficiencies," says Oplink's president and CEO Joe Liu.

For fiscal 2008, revenue was $176.3m, up from $107.5m for fiscal 2007, which only included one month of results from OCP, of which Oplink acquired a majority stake in June 2007 and which became a 100% owned subsidiary in October. Net loss was $6.8m, compared to net income of $13.2m for fiscal 2007.

Excluding transitional costs for contract manufacturing and expenses incurred by OCP relating to its acquisition, non-GAAP net income was $13.9m, down from $19.5m for fiscal 2007.

"We had good sales activity for our passive components through our traditionally large customers and are building our pipeline for future periods," says Liu of fiscal Q4.

"Demand for our active components was strong and, with our offshore manufacturing transition nearly completed, we are now shifting our focus to customer interactions and design-win activities," he adds.

We are now shifting our focus to customer interactions and design-win activities

"We remain confident in the long-term opportunity for the consolidated business as we move into fiscal year 2009."

For fiscal first-quarter 2009 (to end-September 2008), Oplink expects revenue to rise to $38–42m.

● Oplink's board has approved a program authorizing the repurchase of up to $20m of common stock. Repurchases will be made in open market or privately negotiated transactions, funded by available working capital. The program "communicates our long-term confidence in our business and is a good use of our capital at this time," says Liu.

www.oplink.com

Oplink announces senior management changes

Oplink says that at the end of 2008 Joe Liu will resign as CEO and assume the position of executive vice chairman. Current president Thomas P. Keegan will become CEO. Len LeBlanc will remain chairman.

Keegan was appointed president in May after being VP of business development and general counsel over the past year. His career spans more than two decades in business and law, and includes experience working with and advising technology companies and international enterprises doing business in Asia and the USA. As a fluent Mandarin speaker, he has extensive first-hand knowledge of the challenges and opportunities facing technology firms operating in Taiwan and China, says Oplink.

Joe Liu, moving from CEO to executive vice chairman.

Also, Peter Lee, VP of marketing, PLM and strategic planning, has been promoted to chief operating officer.

In addition, Dr Shawn Lin, senior director of technical marketing and customer support, has been promoted to VP of marketing.

We will build on our core business lines of passive components, OMS and transceivers

"Shawn has been a major contributor to the success of our OMS [optical manufacturing solutions] business," says Liu.

"With the promotions of Peter and Shawn, we will build on our leadership positions in our core business lines of passive components, OMS and transceivers," Liu adds.

Opnext grows 15.8% to record $84.2m

For its fiscal Q1/2009 (to end June), optical module and component maker Opnext Inc of Eatontown, NJ, USA has reported record sales of $84.2m, up 24.2% on $67.8m a year ago and 15.8% on $72.7m last quarter, and above its guidance (given in May) of $74–77m.

This has been driven by broad-based growth across most communication product lines, including XFP, XENPAK, X2, SFP and 300-pin tunable form factors (offsetting a year-on-year drop in sales of 300-pin fixed-wavelength modules).

In particular, sales of 10Gb/s and above products grew sequentially 15.5% to $69.4m, while sales of less than 10Gb/s products grew 17.1% to $9.6m, and industrial and commercial product sales grew 18.2% to $5.2m.

Cisco and Alcatel–Lucent represented 44.3% and 10.2% of total sales, respectively, down from 45.7% and 14.3% last quarter. Diversification improved as sales to other top-ten customers (including Juniper, Hitachi, Huawei and Fujitsu) grew 58% sequentially to 31% of total revenue.

Operating income was $2.2m, compared to an operating loss of $0.8m last quarter. Net income was $2.6m, up on $0.9m last quarter.

"Last quarter we stated that we were well-positioned to continue our growth in the 10G and 40G markets in fiscal 2009, while expanding our 40G portfolio to address broader applications," says president & CEO Harry Bosco. "Record top-line performance in the first quarter demonstrates our growth potential and speaks to the strength we are seeing across our customer base."

"Over the last couple quarters, we have noted several reasons for cautious optimism," Bosco continues. "Our near-term outlook has not changed, despite the strong growth experienced in the June quarter. While we believe the growth in broadband applications will drive growth in our business into the future, we continue to see fluctuations in customer spending in any given quarter due to their customers' spending patterns."

For fiscal Q2 (to end-September), Opnext expects revenue to be flat to slightly up on Q1, at $84–87m.

www.opnext.com

Germany's IMM appointed as distributor

Opnext has expanded its network of distributors by appointing IMM Photonics of Unterschleißheim, Germany as an authorized distributor of its optical devices (red and infrared laser diodes) in Germany, Austria and Switzerland.

Established in 1992, IMM is a European supplier for laser, optoelectronics and fiber-optics technology with its own development and production department. Its range includes single components (laser diodes, optics, optoelectronics), sub-systems (collimators and modules) and complete devices.

"IMM Photonics' extensive and loyal customer base in Europe complements Opnext's established level of customer support capabilities," says Bernd Runge, Opnext's VP for Europe sales.

"This opportunity enables us to broaden our extensive spectrum of products to better serve our large customer base," says IMM's managing director Friedrich Raith. "This agreement solidifies our position as a leading supplier and distributor of optical products in Europe," he reckons.

www.imm-photonics.de

JDSU founder to chair GigOptix advisory board

GigOptix LLC of Palo Alto, CA, USA, a subsidiary of GigOptix-Helix AG in Zurich, Switzerland, says that Dr Jozef Straus will be the first chair of its newly formed advisory board.

GigOptix describes itself as a fab-less semiconductor manufacturer of electronic engines for the optically connected digital world, providing high-speed optical physical media dependent (PMD) ICs with a portfolio including modulator drivers, laser drivers and trans-impedance amplifiers (TIAs) for telecom, datacom, Infiniband and consumer optical systems, transmitting at rates of 3.125–100Gb/s, covering all laser technologies (serial and parallel).

Straus co-founded JDS Fitel in 1981 and was instrumental in its merger with Uniphase Corp in 1999 to create broadband and optical communications component maker JDS Uniphase Corp. After retiring as JDSU's CEO in August 2003, Straus held the role of founder emeritus until the end of 2005. Prior to JDS Fitel, Straus held research and management positions with Bell Northern Research and Nortel.

"To call on the advice and experience of such an industry veteran will be of great benefit to GigOptix as we grow our business," says Dr Avi Katz, GigOptix's chairman & CEO.

Straus also serves on the boards of various private high-tech firms. He is a past board member of Group Telecom, Photonics Research Ontario, the Alberta Information and Communication Technology Advisory Board and University of Ottawa's Science Advisory Council.

Straus received the 2004 NRC/CATA Alliance Innovation & Leadership Lifetime Achievement Award as well as the 2001 Engineering Management Award from the University of Southern California. He is also a senior member of the Institute of Electrical and Electronic Engineers.

www.GigOptix.com

Emcore grows 70% year-on-year

For its fiscal Q3/2008 (to end June), Emcore of Albuquerque, NM, USA, which makes components and subsystems for the broadband, fiber-optic and solar power markets, reported revenue of $75.5m, up 70% on $44.4m a year ago and 34% on last quarter's $56.3m.

Fiber Optics revenue was $53.6m, almost double $27.6m a year ago and up 43% on $37.6m last quarter, due mainly to increased demand for parallel optical transceivers and February's acquisition of Intel's Optical Platform Division (for which revenue exceeded expectations). Demand for legacy datacom products continued to strengthen, growing 144% year-on-year and 46% sequentially to record revenue.

Photovoltaics revenue was $21.9m, up 30% on $16.8m a year ago and 18% on last quarter's $18.6m, due to the launch of new concentrator photovoltaic (CPV) component and system products for commercial and utility-scale applications, despite delays in installing the CPV receiver manufacturing line. Satellite-related revenues fell sequentially due to the delay in a customer's program for solar panel products (forecasted in May to fall from $14.2m to $10m).

Fiber Optics gross margin rose from 24% last quarter to a record 27%, due mainly to increased revenue, lower manufacturing costs from the ramp-up in China manufacturing operations, the implementation of cost-reduction initiatives, and improved efficiencies driven by facility consolidation.

PV gross margin was –3%, up from –12% last quarter. The division increased manufacturing capacity for CPV components, but equipment up-time was less than planned, so production was insufficient to absorb the extra overhead costs of the CPV receiver lines entering service. Also, CPV system projects lost $1.8m, due mainly to higher-than-expected freight and installation costs.

Nevertheless, overall gross margin rose from 12% last quarter to 18%.

Operating expenses rose from $19.6m last quarter to $25.3m ($7.2m from the acquisition of Intel's Optical Platform division, including $3.2m related to transitional services provided by Intel). However, with integration ahead of schedule, Emcore expected transitional services to terminate by the end of September.

Operating loss has been cut from $13.5m a year ago to $11.6m (or $8.4m excluding Intel charges): about half from initial commercial deployment of Emcore's CPV system and half from Intel's charges.

Net loss has more than halved from $17.5m last quarter to $7.7m (just $2.8m, excluding Intel charges and stock-based compensation expense).

During the quarter, cash reserves fell by $7m to $23.5m, due mostly to capital expenditure of $5.5m (mainly for CPV component and system business), Intel charges, and an investment in South Korean contract manufacturer Lightron Fiber-Optics Devices Inc.

In July, Australian customer Green & Gold Energy said it was negotiating the sale of its business and could not commit to further purchases under its $79m of CPV-related orders (which include a $39m follow-on order at the end of February). The acquirer aims to negotiate a new purchase agreement. Hence Emcore has cancelled production slots reserved for Green & Gold and adjusted the order backlog, which has consequently shrunk from $158m at the end of last quarter to $109m at the end of June (including $53m of CPV-related backlog).

However, backlog does not include previously announced terrestrial solar power agreements in Canada, South Korea and the USA (since contract terms, production requirements and delivery dates are still being worked out) as well as orders announced after the end of June.

The CPV business will be in a market development phase for the next six months, Emcore reckons.

"Demand continues to be significant as the company continues to sign long-term CPV-related supply agreements with a much more diverse customer base for both land-based and commercial rooftop applications across different geographic markets," says CEO Dr Hong Q. Hou. "While there is some uncertainty of incentives and subsidies in some of our end solar power markets, we are seeing increased market acceptance and continued growth in our terrestrial CPV business," he adds. Emcore has three CPV receiver lines fully operational in Albuquerque, with a fourth operational in China by the end of August. This capacity can serve market demand for the next 12 months, so capital expenditure should slow significantly.

Emcore has experienced a drop in satellite-related PV demand, but expects a rebound in the next few quarters. Government business tends to be 'lumpy', says Hou, but Emcore products are baselines in a number of new satellites programs (with some contracts awarded and some delayed due to Congressional funding). However, new program wins are expected in second-half 2008. Also, commercial satellite business should grow more than 10% year-on-year as Emcore expands its client base and applications.

Despite recent uncertainties, an initial public offering of the PV business is still on track for mid-2009.

Regarding the Fiber Optics division Emcore has a robust new product pipeline. "We are addressing the fiber-optics business sectors where the rapid growth is," says Hou. The business should grow more than 20% year-on-year. "This segment can be a standalone profitable business going forward, barring significant adverse market development."

Overall, with significant revenue growth in the past few quarters, and having controlled operating expenses (positioning for profitability in 2009), the firm expects continued improvement in fiscal Q4/2008.

Emcore appoints new CFO

Emcore has appointed John M. Markovich as chief financial officer (reporting to CEO Dr Hong Q. Hou), responsible for finance, accounting, financial planning, treasury, tax, and investor relations functions. With over 20 years of financial experience, Markovich has a strong background in operational finance, manufacturing, and debt & equity financing transactions. Before joining Emcore, he was executive VP & CFO of venture capital-backed solar energy firm Energy Innovations Inc. Previously, he held leadership positions with several technology and financial services firms, including Optical Coating Laboratories Inc, Western Digital Corp, Pictos Technologies, Tickets.com, and Citicorp.

Interim CFO Adam Gushard becomes VP of finance, reporting to Markovich.

Markovich brings operational and strategic experience to Emcore and will play a key role in leading the execution of Emcore's business plan, says CEO Hong Hou.

www.emcore.com

Emcore wins $40m of orders for CPV cells and receivers

Emcore has entered into two new supply agreements for solar cells and receivers with a total value of over $40m. The larger of the two contracts is a multi-year supply agreement for solar cells, to be delivered over four years.

The products to be delivered will be incorporated into concentrating photovoltaic (CPV) systems developed for commercial rooftop installations as well as utility-scale solar farms.

The customers are targeting CPV deployments in the USA, with a particular focus on the California market. Production has started; about $1m of product was expected to ship in the September quarter.

Emcore says that the award of the purchase agreements further diversifies the firm's terrestrial CPV component order backlog.

Emcore has a line of integrated CPV solar cell products optimized for operation at 500–1000x concentration with a minimum average efficiency of 37%, providing terrestrial systems integrators with a complete photovoltaic solution for their CPV systems. The CPV receiver can be integrated into existing CPV systems.

Emcore claims to be the first firm to provide 20 years of performance warranty. The firm adds that, by choosing its receivers, CPV system developers can focus on advancing their optical design and optimizing the balance of their system, hence reducing their time to market.

The award of the purchase agreements further diversifies the firm's terrestrial CPV component order backlog

SolFocus names ex-Lockheed Martin exec as president

SolFocus Inc of Mountain View, CA, USA, a Palo Alto Research Center spin-off that makes III-V-based concentrator photovoltaic systems, has appointed Mark Crowley as president, reporting to chairman & CEO Gary D. Conley. The firm says that the expansion of its leadership team marks a shift from R&D and product development into the commercialization and volume deployment phase of its business.

Crowley joins from Lockheed Martin Space Systems, where he was VP of West Coast Operations. He takes over responsibilities for product development, delivery, support and execution of the firm's operations.

"SolFocus has recently reached a major milestone in its development as a company, which is the deployment of its first commercial CPV plant," says Conley. Crowley brings a proven ability to address the execution challenges and processes faced in this fast-growth phase, he adds.

Crowley has more than 25 years of technical and program management experience, including at Lockheed Martin as VP of Technical Operations, VP of Programs and Subcontracts, as well as VP and Program Director of the firm's SBIRS program (which used some of the same technologies, such as non-imaging optics, that are used in SolFocus' solar systems).

Crowley's career began at General Electric, then GE/Martin Marietta Astro Space. "As a veteran of the aerospace industry, it is exciting to be a part of a company which is taking space solar cell technology and innovatively incorporating it into solar systems," he says. "As the company moves from product innovation into deployed energy-producing power plants, the cadence of execution shifts."

- At the end of July, SolFocus announced completion of the initial, 200kW phase of the world's first full-scale CPV solar power plant.

The 3MW pilot-plant project in Puertollano is co-ordinated by Spain's Instituto de Sistemas Fotovoltaicos de Concentración S.A. (ISFOC).

SolFocus installed the second, 300kW phase of the project at ISFOC's plant in Almogera, by the end of August.

"We chose SolFocus' CPV arrays as part of the ISFOC project because we believed their non-imaging optical design would provide efficient and reliable systems," says ISFOC's director general Dr Pedro Banda. "We had confidence that they would be able to meet not just the design challenges, but the manufacturing challenges for volume deployment as well," he adds.

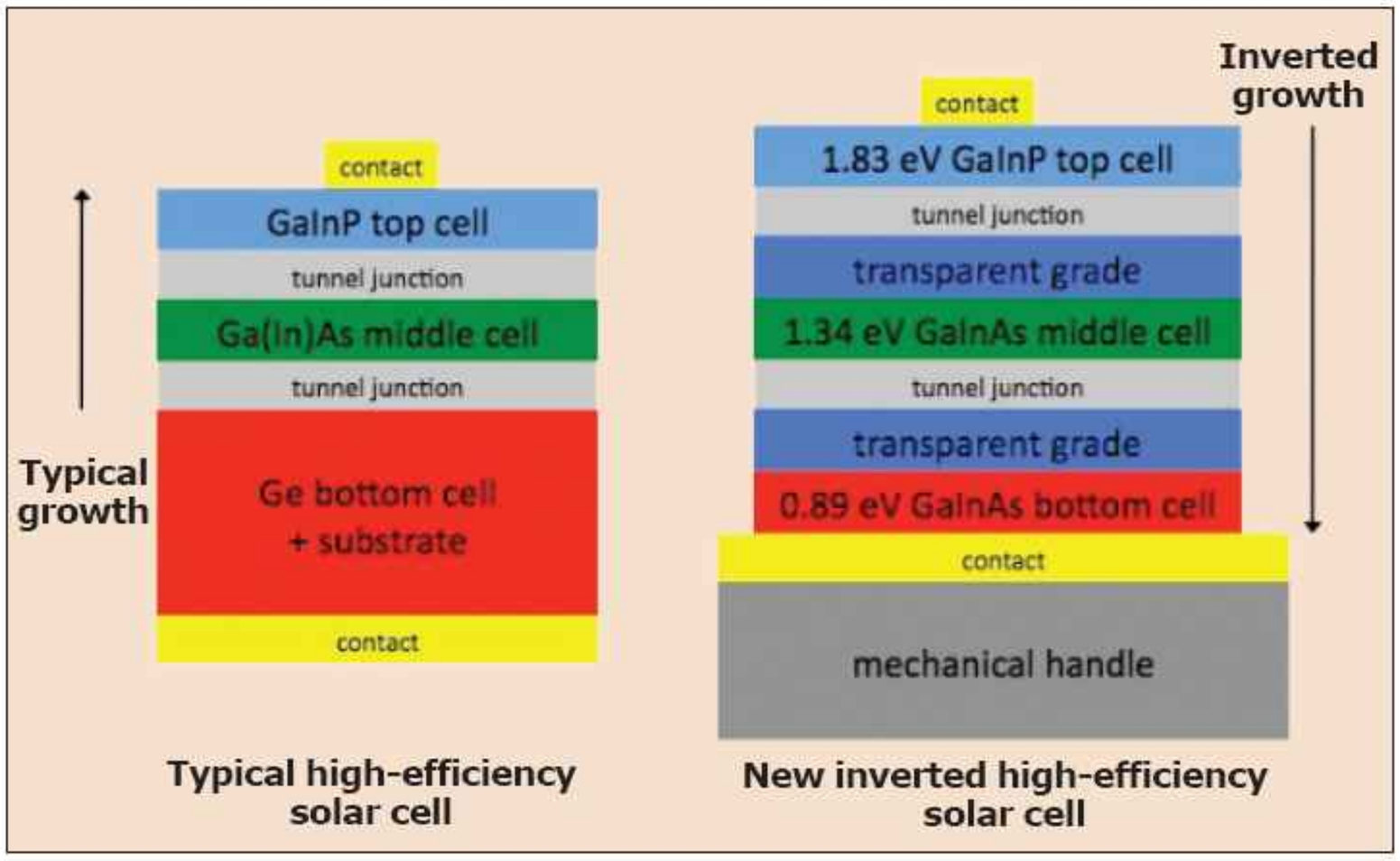
www.solfocus.com

NREL sets efficiency record of 40.8% with inverted cell on GaAs

The US Department of Energy's National Renewable Energy Laboratory (NREL) has set a world record for solar cell efficiency of 40.8%.

The inverted metamorphic triple-junction solar cell was designed, fabricated and independently measured at NREL. Efficiency was measured under concentrated light of 326 suns. The cell is a candidate for the space satellite market (where efficiencies are most important) and for terrestrial concentrated photovoltaic (CPV) arrays, which use lenses or mirrors to focus sunlight onto the solar cells.

The new cell differs significantly from the previous record holder (40.7%, achieved in December 2006 in a terrestrial CPV), which was produced under subcontract by Spectrolab, based on an NREL design. The new design uses GaInP and InGaAs to split the solar spectrum into three equal parts that are absorbed by each of the cell's three junctions, boosting efficiency. But, instead of using a germanium wafer as the bottom junction of the device, the solar cell is grown on a GaAs wafer, before inverting it, and then removing the wafer. The resulting device is extremely thin and light, with advantages in performance, design, operation and cost.



Typical triple-junction solar cell grown on Ge substrate (left) and inverted metamorphic triple-junction solar cell grown on GaAs substrate (right).

NREL's Mark Wanlass invented the original inverted cell. This has been modified by a team led by John Geisz, which further optimized the junction energies by making the middle junction metamorphic (lattice-mismatched) as well as the bottom junction. The properties of the mismatched material allows greater potential conversion of sunlight. NREL says that the new device still has room for improvement.

www.nrel.gov

AIST claims 17.7%-efficient flexible CIGS solar cell

Japan's National Institute of Advanced Industrial Science and Technology (AIST) has achieved an efficiency of 17.7% from copper indium gallium diselenide (CIGS), which it claims is one of the highest for a CIGS solar cell on a flexible metal substrate.

By comparison, in March, NREL achieved record efficiency of 19.5% for a CIGS cell (nearing the 20.3% record for multicrystalline silicon). However, this used a glass substrate. NREL's CIGS cells on flexible metal substrate are 17.1%-efficient.

The carrier density of the p-type semiconductor in a CIGS solar cell is conventionally controlled by adding in an alkali metal such as sodium, in the form of sodium selenide (Na_2Se) or sodium fluoride (NaF). However, these are unstable and have poor reproducibility.

Instead, AIST developed the 'alkali-silicate glass thin layer' (ASTL) method. First, a silicate glass layer is formed on the substrate. By adjusting the layer's film formation conditions, the amount of alkali metal that passes through the backside electrode layer and diffuses into the light absorbing layer can be controlled. This hence aids the reproducibility of adding the alkali metal, improving efficiency.

AIST tested three kinds of substrate: a ceramic substrate, a transparent plastic film provided by Teijin Ltd, and a titanium foil with a coarse surface. The conversion efficiencies that were achieved were 17.7% with the ceramic substrate, 14.7% with the plastic film, and 17.4% with the titanium foil.

AIST unveiled details of the technology at the 4th Annual Symposium of Research Center for Photovoltaics in late July at Japan's National Museum of Emerging Science and Innovation (MeSci) in Daiba, Tokyo.

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IN BRIEF

AVA raises $104m in equity financing

AVA Solar of Fort Collins, CO, USA has completed a $104m second institutional equity funding round, led by DCM and joined by new investors Technology Partners, GLG Partners and Bohemian Companies LLC as well as previous investors including Invus LP.

Building on 15 years of development at Colorado State University's Material Engineering Laboratory (with the support of the National Renewable Energy Laboratory in Golden, CO), AVA was founded in January 2007 to commercialize a process for manufacturing CdTe thin-film photovoltaic modules. A seed round of funding in that February led to construction of an initial pre-production system, followed by a second round of funding that June. AVA says that it has since developed a robust, industrial-scale, continuous process for producing modules with a cost of less than $1/watt. Initial PV efficiencies were 11–13%.

AVA will use the latest funds to complete its first large-scale plant in Longmont, CO in early 2009, which will have an annual capacity of 200MW of PV modules. AVA reckons on employing 500 staff by the end of 2009. "This funding will allow us to move quickly to establish our first manufacturing facility to produce cost-effective PV modules," says CEO Pascal Noronha.

"Our commitment to AVA Solar is founded both on the commercial readiness of the product and their management and engineering team's demonstrated ability to deliver," says DCM general partner Tom Blaisdell. Ira Ehrenpreis of Technology Partners added that "AVA's approach to manufacturing technology is uniquely positioned to meet the market's need for large-scale installations at a cost that enables grid parity."

www.avasolar.com

First Solar expanding manufacturing and development facilities in Ohio

First Solar Inc of Tempe, AZ, USA, which makes thin-film photovoltaic modules based on cadmium telluride, is expanding both its manufacturing operations and its development facilities at its plant in Perrysburg, OH. The investment will add about 500,000ft^2 of manufacturing, R&D and office space, and at least 134 new jobs to the current workforce of 700 in Perrysburg. First Solar is collaborating with state and local leaders on a comprehensive incentive package for the two projects. First Solar says that the incentives are central to its expansion plans in Ohio and are subject to approval by state and local authorities.

The expansion will add a fourth production line and reconfigure the original pilot line to bring the plant to the same four-line configuration as the firm's five other plants in Germany and Malaysia. The expansion should be completed in second-quarter 2010 and will increase the annual capacity at the Perrysburg facility to about 192MW (based on run rates for second-quarter 2008). Also, First Solar will construct a separate facility to support increased development activities associated with its thin-film solar module manufacturing technology.

"Scaling our manufacturing capacity while taking advantage of existing infrastructure will incrementally lower the manufacturing cost per watt at a rate comparable to our lowest-cost facility in Malaysia," says president Bruce Sohn. "The expansion of our operations in Ohio is a direct result of the outstanding achievements of our associates and a strong, ongoing partnership with state and local leaders," he adds.

"This is a great example of how we can harness Ohio's manufacturing base to become the Silicon Valley of alternative energy," commented Senators George Voinovich and Sherrod Brown.

www.firstsolar.com

Solar projects for Southern California Edison

In July, First Solar said that Southern California Edison (SCE), California's largest electric utility, had selected it to engineer and supply the PV power plant system for a 2MW project (33,000 panels) installed in September on the 600,000ft^2 roof of a commercial building in Fontana, CA that will be capable of generating (enough to power about 1300 households).

The project is the first installation in SCE's five-year plan (unveiled in March) to install 3.5m panels covering two square mile in total (250MW of capacity, enough for about 162,000 homes) on about 150 large commercial rooftops (the largest rooftop solar program by a US utility, and the world's largest solar panel installation).

"The project will demonstrate the solar PV system business model needed to dramatically reduce distributive solar electricity costs," says First Solar's CEO Mike Ahearn.

Also in July, the CPUC approved project terms for a 20 year power purchase agreement between First Solar and SCE for the sale of electricity generated by a 7.5MW PV power plant (with an option to increase the size to 21MW), to be built by First Solar in Blythe, CA from next year. When completed, it will be the largest ground-based PV power plant in California. First Solar will serve as the engineering, procurement and construction (EPC) contractor, and maintain the plant over its lifetime.

The projects represent significant steps towards the deployment of low-cost, solar electric generation resources for California, says Ahearn.

www.edison.com

Silicon PV firm Solar Thin Films signs alliance and cross-license agreement with Amelio for CIGS technology

Solar Thin Films Inc of Dix Hills, NY, USA, which provides equipment for manufacturing thin-film amorphous silicon (a-Si) photovoltaic modules, has entered into a strategic alliance and cross-license agreement with Amelio Solar Inc of Ewing, NJ, USA which provides thin-film photovoltaic (PV) modules and facilities.

Solar Thin Films will sell photovoltaic products using copper indium gallium diselenide (CIGS) technology developed and commercialized by Amelio Solar, and has rights to make PV module manufacturing equipment using CIGS technology, subject to certain terms and agreements.

The firm has also signed a purchase agreement for the sale of 18 million shares of common stock owned by the Kiss family. The strategic alliance, cross license and stock purchase agreements are expected to close simultaneously on or about 30 November, coincident with a capital markets transaction being contemplated by the firm.

"As the solar industry continues to shift toward thin-film photovoltaic applications, the technology will continue to evolve," says CEO Peter Lewis. "Our expertise lies in the process know-how required to produce a complete line of manufacturing equipment for the production of thin-film amorphous silicon modules," he notes. "We believe that amorphous silicon offers cost advantages over other commercially viable thin-film materials available in the market. At the same time, we want to prepare for the emergence of other cost-effective thin-film technologies, including CIGS and micro-crystalline, by forming partnerships with companies like Amelio Solar and through our own research and development activities... our plan is to position Solar Thin Film to utilize other thin-film materials as the industry evolves."

We want to prepare for the emergence of other cost-effective thin-film technologies

"Since 2005 we have been working closely with Amelio Solar on developing thin-film CIGS technology," Lewis continues. "We continue to expand the company's technology portfolio without diverting our attention from the many opportunities available to us to expand our share of the amorphous silicon market. Having access to CIGS technology is an important addition to our capability," he concludes.

www.solarthinfilms.com
www.ameliosolar.com

New amorphous silicon PV plant to be used for CIGS development

Solar Thin Films Inc has signed an agreement with Ulster County, New York, to establish its first amorphous silicon solar module manufacturing plant in the USA. The accord was negotiated with Congressman Maurice Hinchey, Ulster County officials, and representatives from the Ulster County Development Corporation (UCDC) and The Solar Energy Consortium (TSEC).

The firm will use machinery produced by equipment design and manufacturing subsidiary Kraft Electronikai Srt. of Budapest, Hungary (which Solar Thin Films acquired in 2006). It expects the plant to be able to accommodate six lines of equipment capable of producing 36MW of module power.

Solar Thin Films will also use the new site for research into the enhancement of amorphous silicon module efficiency as well as the development of copper indium gallium diselenide (CIGS) photovoltaic panels. Previously, in January 2007, Solar Thin Films signed a three-year strategic cooperative R&D agreement for Renewable Energy Solutions Inc (RESI) of Ewing, NJ, USA to design and develop manufacturing equipment and turnkey facilities for CIGS-based thin-film PV modules.

The new facility should create a 'substantial number' of new jobs in Ulster County over the next five years.

"Today we take another enormous step forward in our goal of establishing the Hudson Valley and all of New York as a national and international hub for solar R&D," said Congressman Hinchey. He also welcomed Solar Thin Films into The Solar Energy Consortium (an industry-led not-for-profit organization formed in June 2007 and based in Hudson Valley whose aims are to meet New York state and national demand for energy independence and sustainability).

Solar Thin Films will use the new site for the development of CIGS photovoltaic panels

"TSEC and the Ulster County Development Corporation have assisted Solar Thin Films in finding an appropriate factory site, have assisted us in satisfying our financial needs, and have been instrumental in forging potential power partnerships with local utilities," says the firm's chairman Robert Rubin.

Solar Thin Films says that it will apply for a $10m industrial development bond with the assistance of the UCDC to aid the purchase of equipment. The firm says that it will ultimately invest about $60m in the manufacturing and research of components.

CdTe PV progresses to mass production

In the past few years, renewable energy sources, particularly solar-based, have become a favorite for news reports and venture capital; as with many 'hot topics', it continues to be difficult to separate fact from the hope and spin. However, it is clear that semiconductor-based solar energy conversion in some form will be a leading contributor to future renewable energy strategies. One company has accelerated its plans for mass production of CdTe thin-film photovoltaic modules and others are following the lead, Dr Mike Cooke reports.

While world photovoltaic (PV) production is dominated by Japan and Germany, the USA has pioneered and leads in many of the lower-cost thin-film techniques just coming into mass production. In 2007, thin film constituted 65% of US PV production (Figure 1) with the top thin-film company being First Solar, according to PV News. First Solar produces solar modules based on cadmium telluride (CdTe) — see Figure 2. According to one top-ten ranking [1], First Solar came fifth globally in terms of production for solar modules of all types, making 200MW out of the world total of ~4300MW. The top four were producers of traditional silicon wafer based modules.

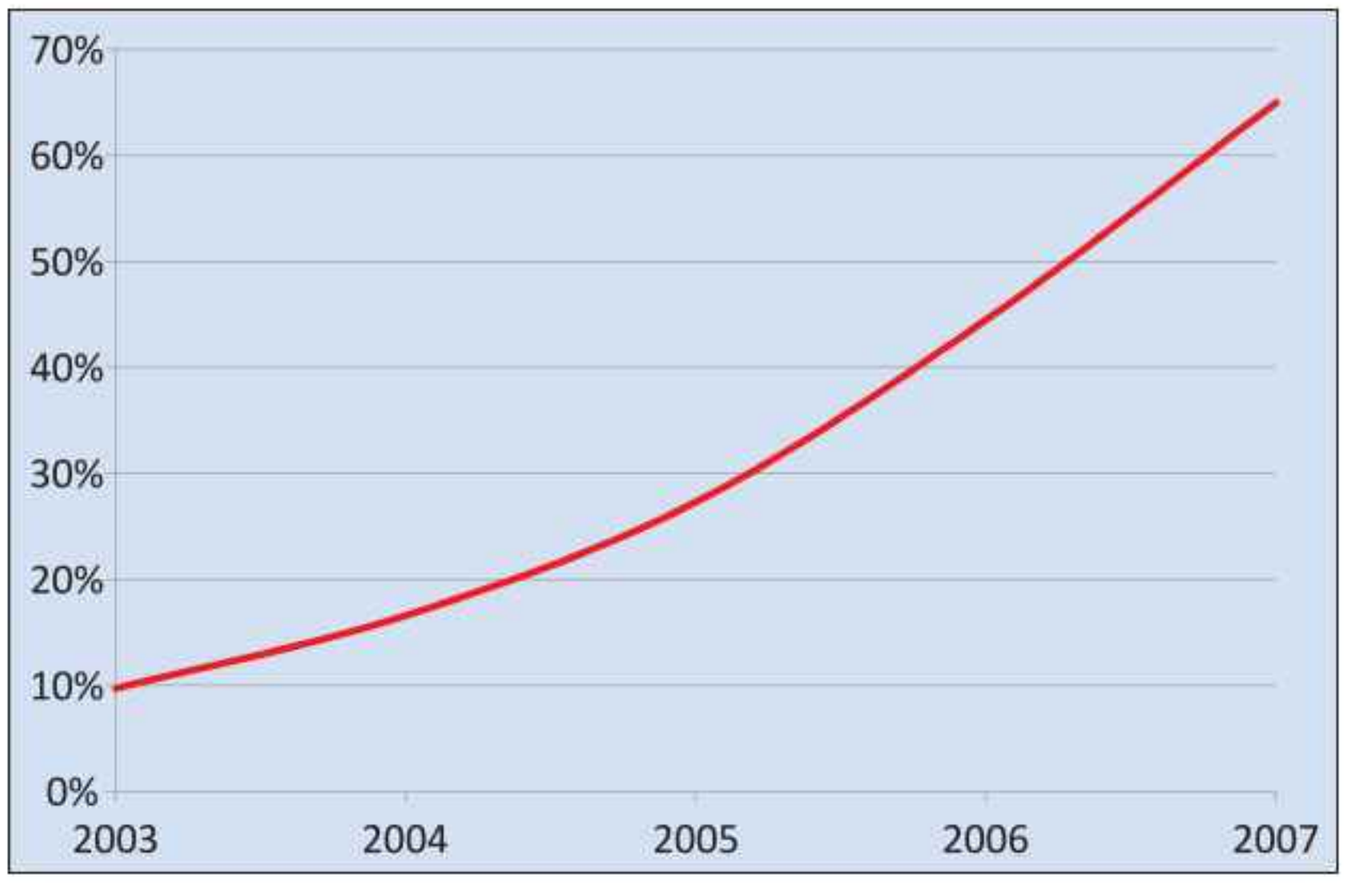

Figure 1. Percentage of US PV module production that is thin-film.

CdTe is a direct-bandgap semiconductor, which enables it to convert solar energy into electricity more efficiently than indirect-bandgap semiconductors such as silicon. The component elements of CdTe are byproducts of the mining and production of metals such as zinc and copper. These materials are present in abundant quantities to support multi-GWs of annual production, according to First Solar. However, others — supporting competing technologies [2] — point to recent increases in the price of tellurium. From averaging $10/pound weight in 2003, the price peaked at $96/pound in 2005 and was $80/pound in 2007, according to the UK-based publication Mining Journal. These price hikes reflect increased use of the element across the electronics industry (e.g. use in rewritable optical storage).

Detractors also point to environmental, safety and health (ES&H) concerns about use of the highly toxic element cadmium. CdTe producers have responded with comprehensive cradle-to-grave care for their product in life-cycle management and take-back recycling schemes to decommission CdTe modules safely and recycle the materials. Supporters also point to numerous safety reports such as [3], which concludes: "Large-scale use of CdTe PV modules does not present any risks to health and the environment, and recycling the modules at the end of their useful life completely resolves any environmental concerns. During their operation, these modules do not produce any pollutants and, furthermore, by displacing fossil fuels, they offer great environmental benefits. CdTe PV modules appear to be more environmentally friendly than all other current uses of Cd." Indeed, the burning of fossil fuels is itself a source of cadmium emissions.

CdTe's energy bandgap of 1.45eV ($\lambda \sim 855$nm) means that less of the absorbed photon energy is dissipated as heat compared with narrower-bandgap silicon (1.12eV, 1107nm). Many consider 1.36eV (910nm) to be the optimum bandgap for single-junction solar cells. In addition, the fall-off in solar conversion efficiency at increased temperature is less for CdTe compared with silicon. This enables effective use under higher-temperature ambient conditions. CdTe also seems to be

better at converting less-than-ideal lighting (cloudy weather, dawn, dusk). Theoretically, CdTe is capable of efficiencies of traditional silicon-based modules using only about 1% of the semiconductor material.

In addition to CdTe, thin-film devices can be based on various competing chemicals such as amorphous or poly-crystalline silicon and copper indium (gallium) diselenide (CIS/CIGS). Today, CdTe module installations are predominantly on commercial rooftops and in large-scale utility ground-mounted systems — which is expected to continue up to 2012 [4]. With increasing power efficiency, CdTe manufacturers may begin to move from large-scale projects to devices aimed at the residential mass market.

Potential for thin-film PVs

Specialists at the US National Renewable Energy Laboratory (NREL) [5] have assessed the potential capabilities of various thin-film technologies based on present day 'champion cell performance' in each technology class as well as the expectations of this performance feeding through to mass-manufactured modules.

These authors cite First Solar's FS-275 CdTe-based module as having an efficiency of 10.4%, which attains 63% of the performance of champion cells. This compares with the leading monocrystalline silicon wafer product using a special junction formation from SunPower (315), which has 19.3% efficiency (78% that of a champion cell). CIGS products come in at 11% (WürthSolar WS11007/80) and 8.1% (GSE Solar GSE 120-W), or 55% and 41% that of the CIGS champion cell, respectively.

A somewhat crude model where manufacturing achieves 80% of current champion cell attainments — along with a factor of two to express the production cost advantage of thin-film technologies over monocrystalline silicon wafer devices — leads to CIGS and CdTe being classed as 'highly competitive' (Table 1). The lower cost of thin-film PVs is related to the reduced amount of semiconductor material that is used. Silicon wafer-based production in recent years has shifted from relatively low-grade to premium-grade Si, increasing costs and thus boosting the thin-film advantage.

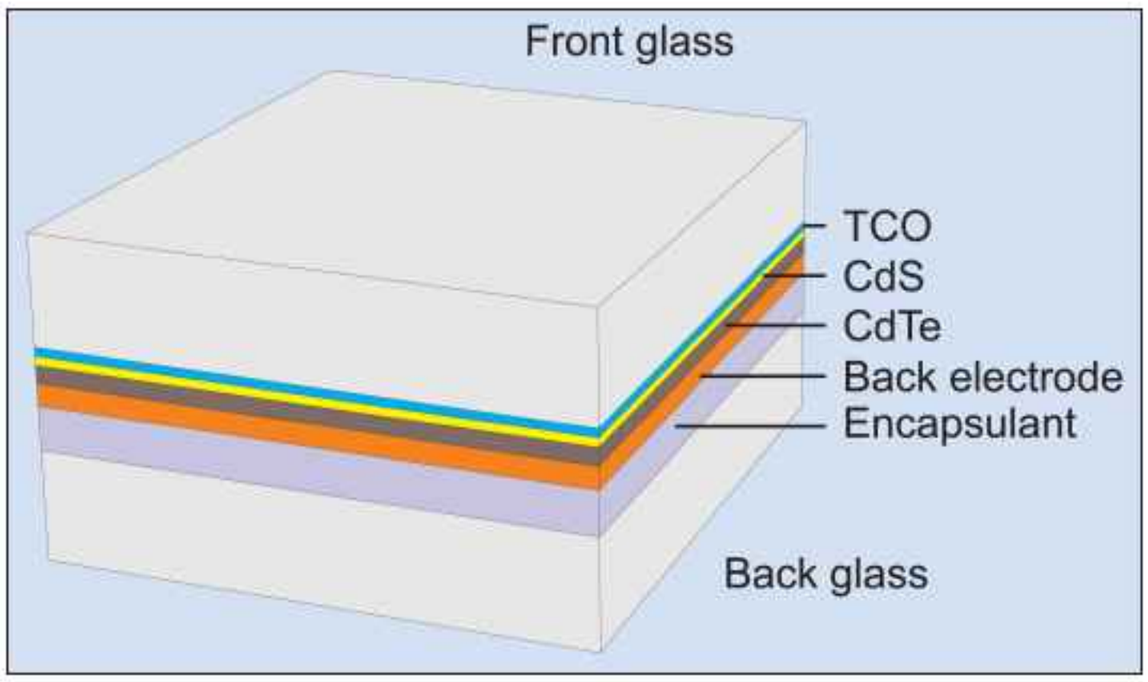

Figure 2. Typical layer structure for single-junction CdTe PV module. TCO = transparent conductive oxide.

In this evaluation, CIS/CIGS technology has some advantage over CdTe but, with such crude assumptions, actual manufacturing details and developments could change the cost/benefit equation. In addition, CdTe is clearly closer to the 80% of champion performance assumed in the analysis. This is the result of impressive progress by First Solar in recent years (Figure 3).

Expanding volumes

In first-quarter 2008, First Solar reported production costs of $1.14/W, which the company compared with silicon wafer modules at $3.00–3.25/W. As CdTe production-line volumes expand, further cost reductions are to be expected from the economies of scale. By 2015, boosting yields (from ~90% to 95%) and efficiencies (from ~9% now up to 13%) could reduce production costs to $0.70/W (Table 2). First Solar has set $0.70/W as its target for 2012, a figure that is seen as being price competitive with grid-parity electricity.

First Solar's modules use polycrystalline CdTe in a simple single-junction formation. The firm says that its high-throughput automated operation does not need expensive cleanroom arrangements or other specialty equipment. Up to the end of 2007, First Solar had installed some 300MW of solar modules globally.

The company is now building a production facility in Malaysia that is due to be fully operational in the

Table 1. Anticipated future module efficiency and relative cost based on demonstrated champion cell performance from [5]. Future commercial module performance is estimated at 80% of current record cell efficiency. The column of future relative cost gives a 50% advantage to thin-film PV.

Technology	Future commercial module performance	Future relative performance	Future relative cost	Assessment
Si (non-standard)	19.8%	1.18	0.85	competitive
Si (standard)	17.0%	1.00	1.00	reference
CIS/CIGS	15.9%	0.92	0.54	highly competitive
CdTe	13.2%	0.78	0.64	highly competitive
a-Si (1-j)	8.0%	0.47	1.06	about the same
a-Si (3-j), (or a-Si/nc-Si)	9.7%	0.57	0.88	competitive

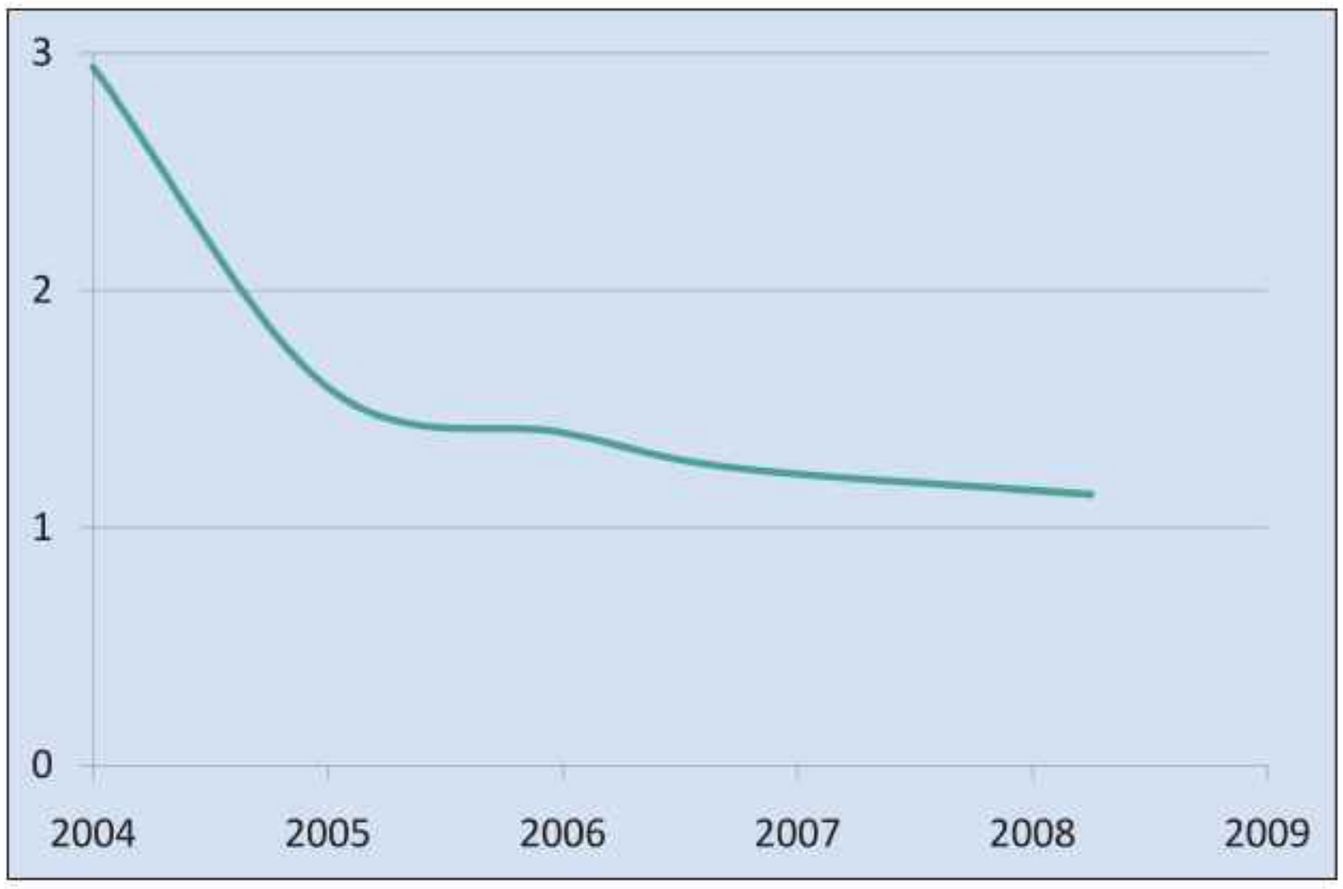

Figure 3. Efficiency of First Solar modules ($/W) 2004–2008.

second-half of 2009 at an expected cost of $680m. The site will consist of four plants capable of producing 720MW of solar modules annually, employing 2000 staff. The first plant at the facility was formally inaugurated this July. The firm is also due to add to its facilities at its Ohio base, moving up to 192MW (due to be completed in second-quarter 2010). This adds to some 120MW at its German operation. Further development facilities are also to be added at Ohio. First Solar has the stated aim of having more than 1GW in capacity by the end of 2009, which is more than double 2008's expected 495MW (Figure 4).

First Solar has built on the work of its predecessor, Solar Cells Inc, which carried out NREL-funded research from 1991. First Solar itself was founded in 1999, and commercial products became available in 2002. For 2008–2012, the firm has 3.4GW of long-term supply agreements in place. Among the projects for which First Solar is supplying and installing modules is a 40MW plant in Brandis, Germany, which is billed as the world's biggest photovoltaic power plant, being constructed in conjunction with Juwi Solar for EUR130m. In February 2008, some 12.7MW of this 40MW total was connected to the German grid. The project is due for completion at the end of 2009.

Southern California Edison is also to install First Solar panels in a project involving about 150 commercial rooftops covering two square miles. Indeed, First Solar's devices are to be used at the first site that covers 600,000 square feet. The potential power output is rated at 2MW. This site is due to be plumbed into the grid this September. The full five-year project is due to use 250MW of solar cells.

First Solar is not the only company producing CdTe modules. Calyxo GmbH (which was established in 2005 as a 100% subsidiary of leading PV maker Q-Cells) set up an 8MW CdTe pilot line in summer 2007, based on a worldwide exclusive technology license from US-based Solar Fields LLC. In October 2007, Solar Fields and Calyxo were merged into a new company, with 93% of shares going to former Calyxo and 7% to Solar Fields. The firm now has full rights over the technology and a 100% subsidiary in the USA. Calyxo USA will focus on CdTe R&D, while Calyxo GmbH in Germany is now completing its pilot facility with a production capacity of 25 MW. A further 60MW of capacity is to be added at a site next to the present production facility in Germany. Another German company, Antec Solar, also has some CdTe thin-film production.

AVA Solar is a further CdTe solar module manufacturer that is planning large-scale facilities with technology that was developed and incubated (with NREL support) at Colorado State University. The firm says that the fully automated, dry, in-line, continuous, single-pass system that it uses has very high throughput and yield. Pilot production is due in second-half 2008 and a large-scale 200MW manufacturing facility is to be completed in early 2009. The company reports testing that validates a 30+ year product life, and initial device efficiencies ranging from 11% to 13%.

"We are very happy with our initial pre-production runs and have decided to move up production plans on our existing manufacturing line," said AVA's president & CEO Pascal Noronha earlier this year. "Although this will be relatively limited production, we intend to accelerate our production learning curve and get our products into the market faster than we thought possible last year."

AVA is a recipient of a US Department of Energy Solar America Initiative (SAI) PV Incubator Award. Primestar Solar is another firm receiving incubator funds from SAI. General Electric Energy (GE Energy) has recently become a majority shareholder. The firm has yet to make a concrete announcement concerning pro-

Table 2. A view of prospects for CdTe development to 2015 [4].

Parameter	2007 status	Goal for 2015
Commercial module efficiency	>9%	13%
Champion device efficiency	16.5%	18%–20%
Module cost ($/W)	1.21	0.70
$/watt installed system cost	$4–5/W	$2/W
Levelized cost of electricity (LCOE)	18–22 ¢/kWh	7–8 ¢/kWh
Overall process yield	90%	95%
Identify relevant degradation mechanisms & develop appropriate accelerated lifetime tests (ALTs) for device and mini-modules	1.2%/year	0.75%/year

duction facilities, and its first product is described in the future tense on the firm's website.

On the development side, Sunovia and EPIR Technologies see CdTe as part of a multi-junction solar cell approach (using ZnTe and Si components) that is hoped will reach efficiencies of about 32%. These firms believe that, since CdTe is more abundant and affordable than other compound semiconductors such as InGaAs/InP/Ge, efficient multi-junction solar cell performance can be produced at significantly lower cost. InGaAs/InP/Ge cells can produce efficiencies only slightly better (~34%) than that expected for ZnTe/CdTe/Si. Whereas the Ge substrate makes up 65% of the cost of the III–V structure, Sunovia/EPIR believe that the use of silicon substrates will make the substrate cost factor almost disappear, particularly with larger-diameter wafers. Sunovia representative Don Sipes sees production on silicon wafers of 200mm or larger as being possible.

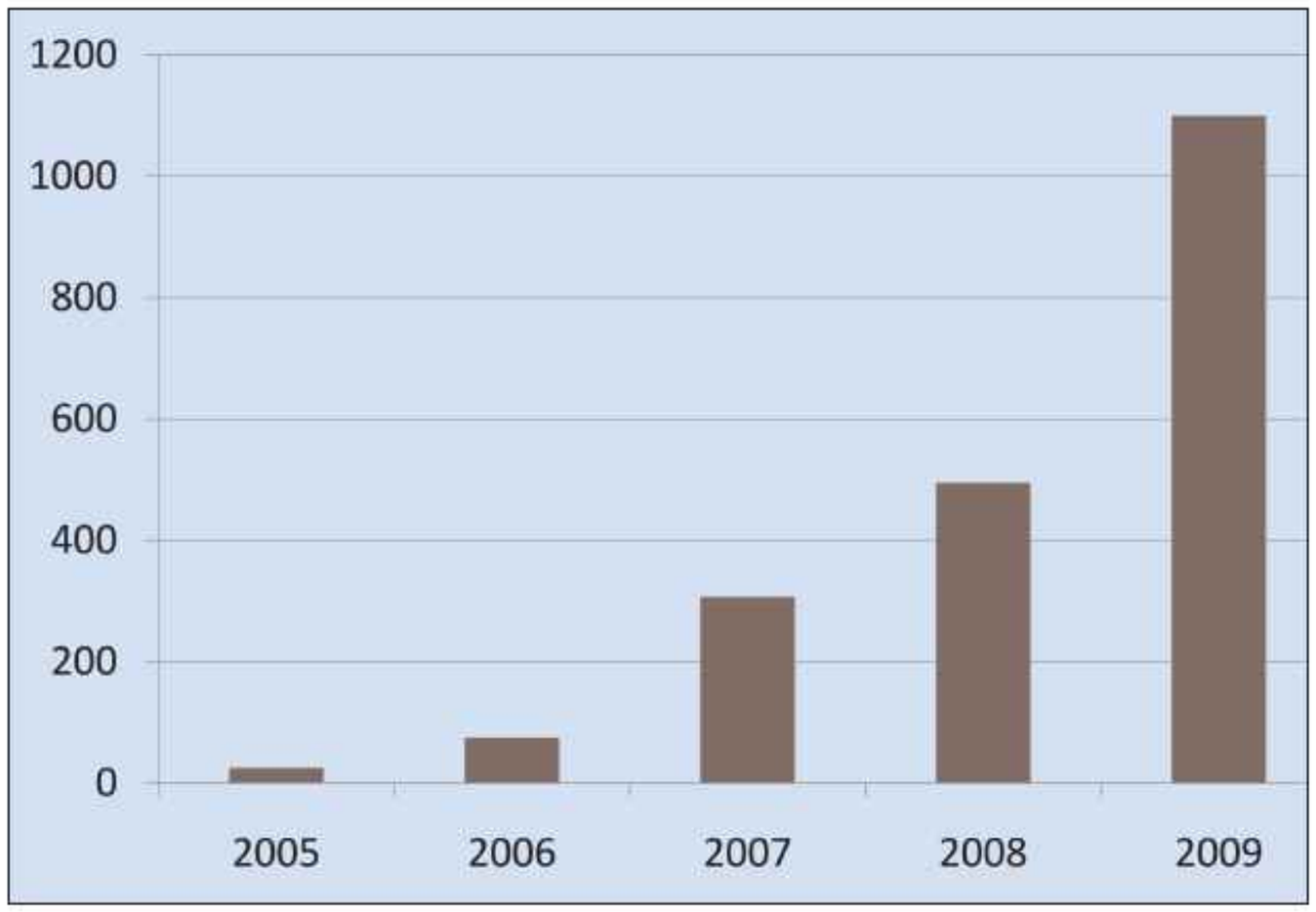

Figure 4. First Solar's capacity (MW): 2008–2009 projected.

More than $25m has been invested into the firms' core CdTe research, development and design for a high-throughput CdTe-based manufacturing facility. The firms say that advanced manufacturing concepts should allow the production of more than 100MW of high-efficiency CdTe solar cells within a 10,000ft^2 area. The first manufacturing system is to be operational in less than two years time and will have the capacity to produce more than 10MW of CdTe-based solar cells during the first year. The initial target market will be the commercial and utility sectors. Manufacturing is designed to be 'scalable', meaning that additional capacity can be added quickly, as required.

Single-crystal material grown by high-throughput MBE deposition methods could reach 24%... above 30% is achievable for optimized two-junction CdTe/Si solar cells in which both the CdTe and the silicon act as solar energy absorbers

The basis for the high-throughput manufacturing technologies for growing single-crystal CdTe on silicon substrates was first demonstrated at the University of Illinois at Chicago and transferred by EPIR into night-vision infrared (IR) sensors for military application over the past decade. While amorphous or polycrystalline CdTe is thought to offer an upper limit of 16% efficiency, EPIR calculates that the single-crystal material grown by its high-throughput molecular beam epitaxial (MBE) deposition methods could reach 24%.

This efficiency was calculated assuming no antireflection coating and no back mirroring under a terrestrial solar spectrum with the standard global tilt of 37° (AM1.5G). The calculation was performed for a cell having a thin top layer of n-type cadmium sulfide on 4μm of p-type CdTe (the most common CdTe solar cell configuration). For a CdTe solar cell of a proprietary design, EPIR calculated an efficiency that is above 26%. It believes that a maximum efficiency above 30% is achievable for optimized two-junction CdTe/Si solar cells in which both the CdTe and the silicon act as solar energy absorbers.

This May, the firms announced that they had created improvements in the crystal quality of 3-inch CdTe wafers more than twice as great as all of the improvements achieved over the last decade. The companies also claim that the improvement in across-the-wafer uniformity is even more striking than the great improvement in crystal quality at the center. This gives a high likelihood for rapid progress to commercial large-scale manufacturing of even larger-area CdTe/Si wafers, for even lower costs and faster production.

Finally, silicon solar cell manufacturer Xunlight is also exploring CdTe by, in April, establishing the subsidiary Xunlight 26 Solar (X26) to develop and commercialize lightweight and flexible solar cells based on CdTe and other II–VI compound semiconductors. Presently, CdTe solar cells are produced on rigid soda-lime glass. X26 has received a $997,000 grant from the State of Ohio under the Alternative Energy Program to continue development of flexible CdTe solar cells. The project will be carried out in collaboration with the University of Toledo and Akron Polymer Systems of Cleveland, OH. ■

References

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Central delivery of TMGa for lower-cost epi

To open up new markets, the LED industry must reduce the price of its products. A new central delivery system for trimethyl gallium (TMGa) promises to help by reducing the cost of epitaxial film growth, says Egbert Woelk of Rohm and Haas.

Since its beginnings in the early 1970s, the metal-organic chemical vapor deposition (MOCVD) process has been fed by liquid metal-organic precursors stored inside each tool. For trimethyl gallium (TMGa) in particular, the amount of precursor stored in these on-board sources has grown over the years (albeit at a slower rate than the growth in consumption of TMGa). This means that an ever-increasing fraction of the price of the sources has been used for building and maintaining the fleet of stainless-steel bubblers required for the traditional on-board delivery scheme.

A new alternative to the traditional delivery schemes presents an opportunity to reduce the cost of epitaxial growth. The cost of operating a supply chain with a large number of small bubblers is higher than operating with fewer cylinders that are larger in capacity. The cost of moving each unit is independent of the bubbler size, and a cylinder with a larger capacity means less change-out time. The technical viability and cost savings of a large-cylinder (20kg) supply chain have recently been demonstrated.

The evaporator benefits from permanent installation: gas paths, intermixing, phase separation (splash shields) and level sensing are optimized and more expansive compared to a simple on-board cylinder

The LED industry, in particular, uses TMGa in large quantities. Large LED fabs have as many as 50 MOCVD reactors at one site. Currently, all but a few of these MOCVD reactors use small on-board TMGa sources. The delivery of TMGa from one central source of 20kg to a number of reactors reduces the cost of operating the fab simply by putting a team of 'small-bubbler changers' to a more productive use.

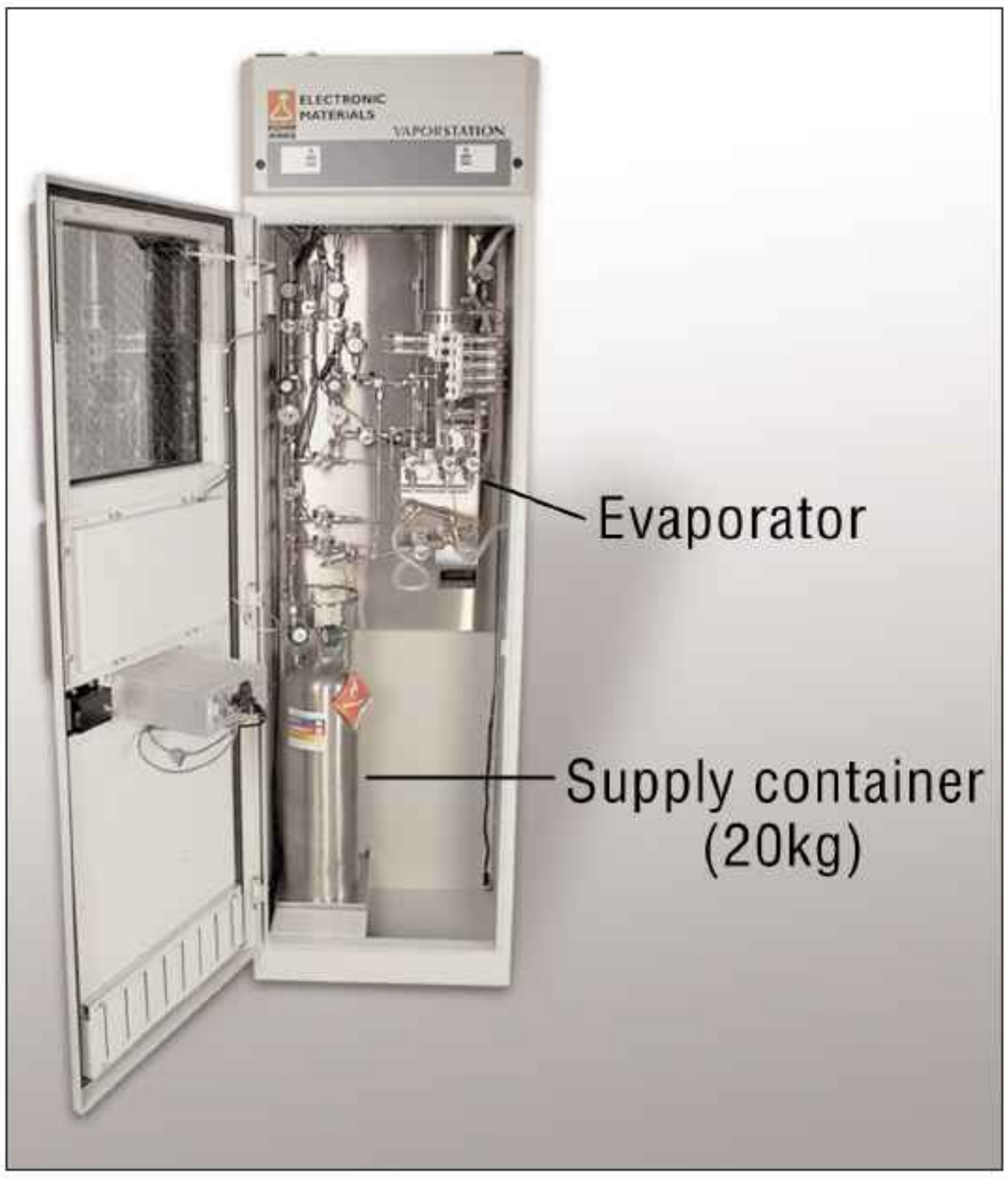


Figure 1. A central vapor delivery system, which uses the same space as a gas cabinet and delivers the vapor of a liquid precursor to several MOCVD reactors.

The most straightforward way to deliver the TMGa is in the form of a vapor in high-purity hydrogen. As a result, TMGa delivery becomes identical to the delivery of any other gaseous source, such as ammonia, arsine and phosphine. The challenge is to convert the liquid TMGa into the vapor 'on demand' with a precisely controlled concentration and the flow required by the fab. This challenge can be met by using a metering valve upstream of a specially designed TMGa evaporator and a pressure sensor downstream from the evaporator. If there is no demand for TMGa from the fab, the metering valve is closed. When a fab is drawing a TMGa flow, the control circuitry will open the metering valve in order to keep the pressure at the pressure sensor constant. The result is that the output of the unit is the exact amount of flow that the fab requires at a precisely adjusted delivery pressure.

The evaporator is essentially a device in which the carrier gas 'bubbles' through the TMGa and picks up the TMGa vapor. The evaporator benefits from perma-

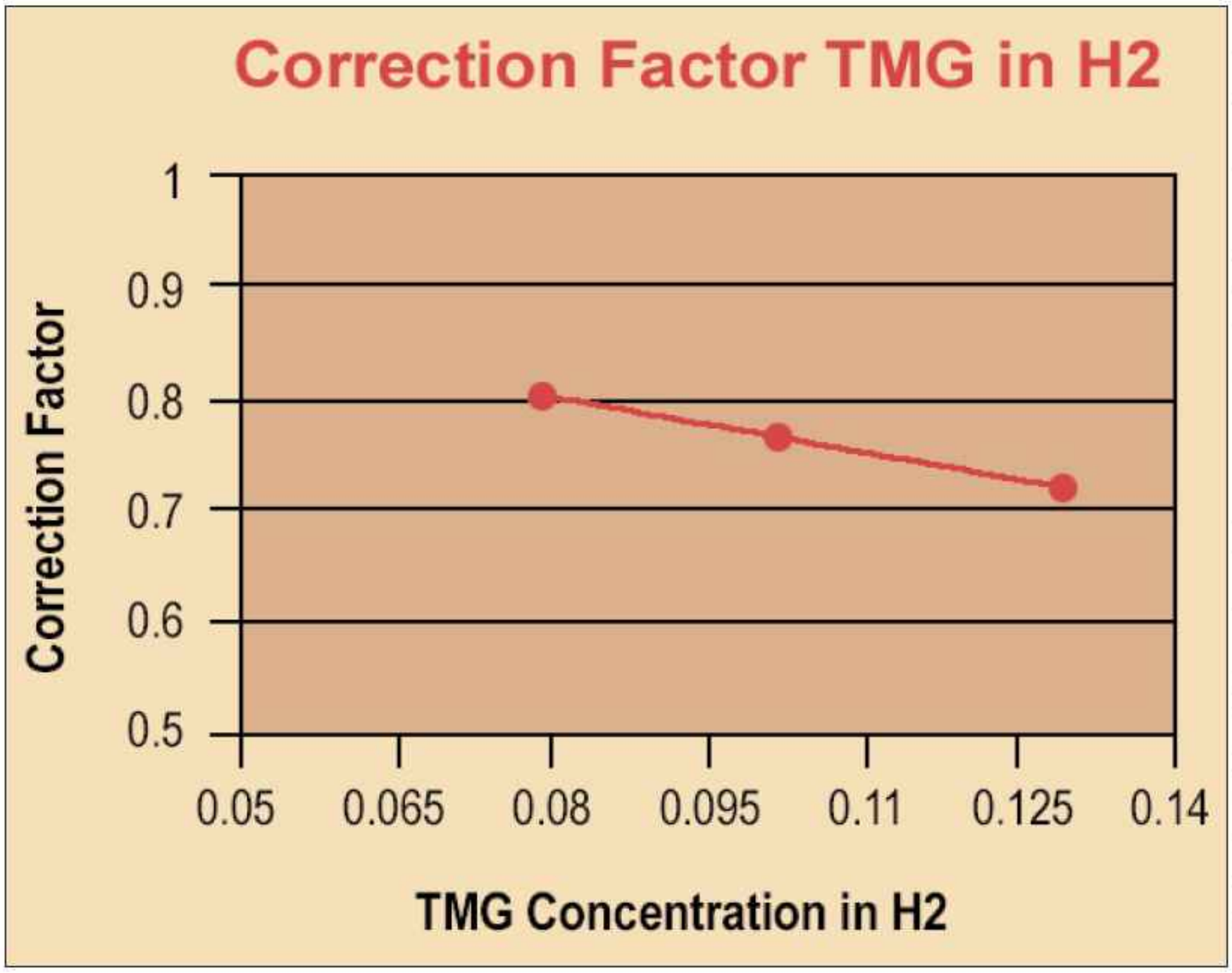


Figure 2. A correction factor has to be applied when using a hydrogen-calibrated MFC with an H_2/TMGa mixture. The correction factor changes with the TMGa concentration.

nent installation: gas paths, intermixing, phase separation (splash shields) and level sensing are optimized and more expansive compared to a simple on-board cylinder. The fill level in the evaporator is maintained within narrow limits by automatic replenishment from the large supply container. Figure 1 shows a picture of Rohm and Haas Electronic Materials' VaporStation central metal-organic precursor delivery system, which is designed and manufactured in cooperation with Matheson Tri-Gas Inc.

The MFC will be exposed to the TMGa: passing a TMGa vapor through an MFC has not been done previously in a production environment

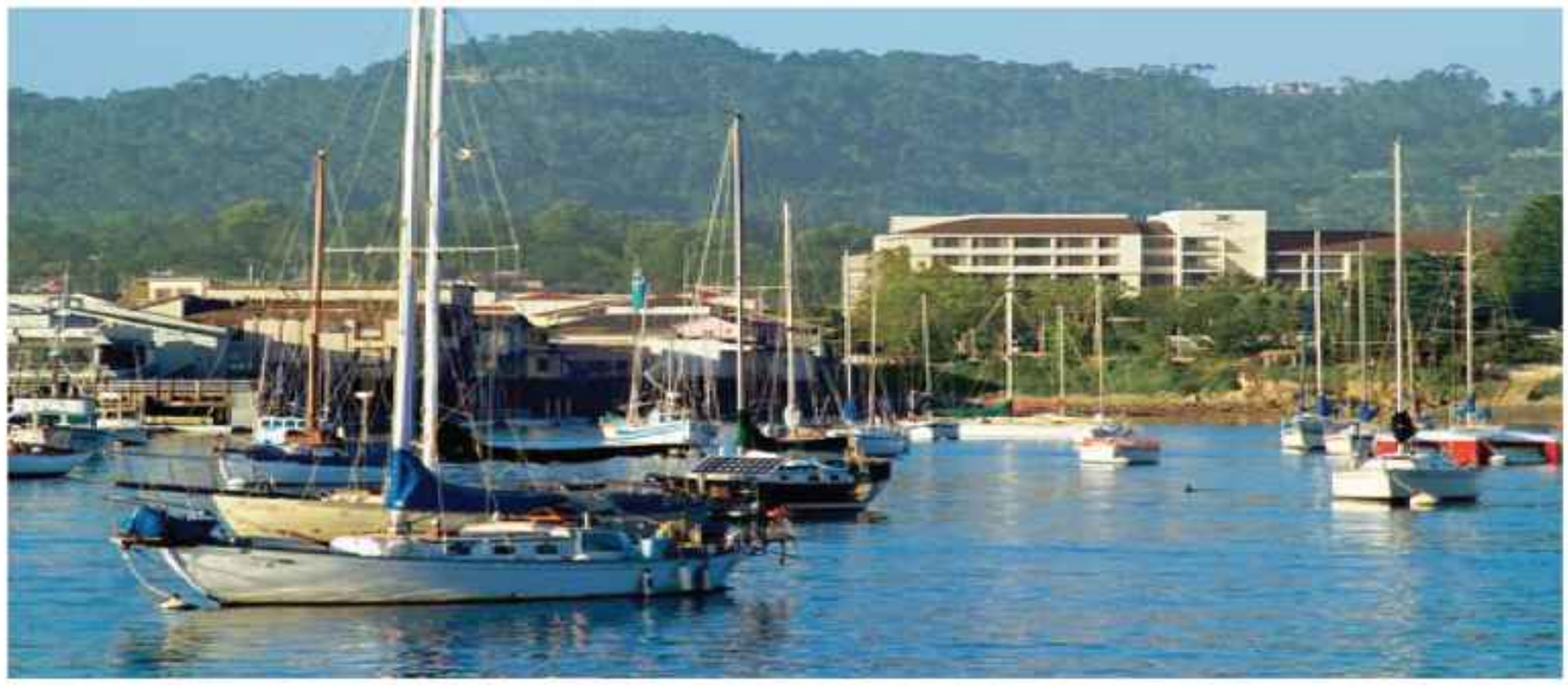
The use of a vapor-transport central TMGa delivery system allows for simplification of the MOCVD reactor: one thermal bath per TMGa line — a large part of a system footprint — can be eliminated. In future MOCVD reactors, the TMGa source will look like a gas source, which typically have much slimmer footprints. Also, just as in gas sources, the mass flow controller (MFC) will be exposed to the TMGa: passing a TMGa vapor through an MFC has not been done previously in a production environment. Rohm and Haas' own validation of the new TMGa delivery concept encompassed long-term MFC stability tests. TMGa exposure in excess of 100 hours did not reveal any de-calibration of the MFC. The first industrial users of central TMGa delivery systems have now been operating for more than a year, and their MFCs have not shown any signs of premature failure.

The calibration of a TMGa MFC changes depending on the TMGa concentration of the vapor. Figure 2 shows the calibration curve. In general, the actual flow decreases with the increase in TMGa concentration. If the set point is unchanged, the MFC will still read the original pure carrier gas flow, but the actual flow will be lower. For a given TMGa concentration, a correction factor has to be applied to the set point to obtain the desired actual flow.

Under the new infrastructure scheme, up to 10 MOCVD reactors can be connected to one central delivery system. In the event of a failure of the central supply cabinet, all reactors would be idle, so the probability of such an event has to be minimized. The central delivery system contains relatively few active components, all of which are extremely reliable. As of this writing, all installed units have run a collective total of approximately 60,000 hours and supplied germanium and gallium metal-organic precursors. During this time, two metering valve failures were recorded, and the root cause was determined to be incorrect installation. Backup schemes to safeguard against outages of TMGa flow are available.

It appears to be almost a certainty that economic pressures will force the LED epitaxy industry to reduce costs wherever possible. The legacy model of TMGa delivery — on-board sources — will prove to be too expensive to operate compared with the new model of central delivery. The economic and technical benefits of central TMGa delivery systems have been validated at the newest and most efficient LED fabs. In the future, competing in the LED epi market while using legacy TMGa source schemes will be a much harder task.

Author: Egbert Woelk PhD, marketing director Metalorganics, Rohm and Haas Electronic Materials



The 2008 IEEE Compound Semiconductor IC Symposium

We cordially invite you to the 30th IEEE Compound Semiconductor IC Symposium (CSICS) being held October 12 – 15th in beautiful Monterey, California. The high-performance wireless and high-speed digital communications markets are thriving due to impressive strides in new materials and devices, greater integration levels, novel circuit implementations, and ever-changing systems partitions. Over the last 30 years the Symposium has been and continues to be the preeminent international forum in which advances in semiconductor circuit and device technology are presented, debated, and discussed. The scope of the Symposium encompasses devices and circuits in GaAs, SiGe, InP, GaN, and InSb as well as targeting the fields of RF/mm-Wave CMOS and high-speed digital CMOS to provide a truly comprehensive conference.

We are pleased to announce that CSICS will co-locate for 2008 with the IEEE Bipolar / BiCMOS Circuits and Technology Meeting (BCTM) in Monterey. Joint functions, including a plenary session, social functions and the exhibition, will permit cross-fertilization of ideas between these two technical meetings.

The 2008 CSIC Symposium is comprised of a full 3-day technical program with approximately 42 regular and 17 invited papers, the Sunday Short Course entitled"A Modeling Toolbox for RF Designers", and an industry Technology Exhibition. The Symposium will again offer the popular introductory level Primer Course on "Basics of Compound Semiconductor ICs". Highlights of the technical program include Robert Chau's plenary presentation on"Integrating III-V on Silicon for Future Nanoelectronics". Panel sessions include "GaN Technology for mm-Wave Applications - Will it Replace all Others?, "Is There Anything that CMOS Cannot Do? PA? Automotive Radar?", "Will the Next Generation Handset Technologies Please Stand Up?" and "Which Compound Semiconductor Technology Will Be Squeezed Out of the Walden Chart?"

The CSICS Technology Exhibition will take place in the Monterey Convention Center adjoining the Portola Hotel. The close proximity of the Exhibition and the technical sessions will promote a highly integrated experience for our attendees. The Exhibition will offer our vendors an opportunity to showcase various products and services including specialty semiconductor materials (epitaxy, substrates, high purity gases and related compounds), manufacturing equipment including photolithography, etch, thin films, ion implantation, wafer surface analysis and metrology equipment and services, test and characterization equipment, simulation and modeling software. More information on the CSICS Exhibition can be found on the website www.csics.org or by contacting the Exhibition Manager, Sue Kingston, at s.kingston@ieee.org.

To complement the Technical Program, there are several social events which include the Sunday Evening CSICS Opening Reception, the Monday CSICS Exhibition Opening Reception, the CSICS-BCTM Tuesday evening Theme Party, and the CSICS Exhibition Luncheon on Tuesday. The Theme Party will take place at Chateau Julien Wine Estate which is nestled in the nearby Carmel Valley mountains. This event will include musical entertainment, wine tasting, tours of the vineyard and estate, and a feast in the estate courtyard.

The Symposium will be held at the Portola Hotel & Spa at Monterey Bay. Situated 115 miles south of San Francisco and 350 miles north of Los Angeles, Monterey features a dazzling waterfront, a lush urban forest, and a rich array of historic and cultural resources, museums, gardens, and recreational activities. For registration and further information please visit the CSICS website at http://www.csics.org. Further questions may be addressed to the Symposium Chair, William Peatman at wpeatman@anadigics.com

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Fax: +353 (0) 2586331
www.emfsemi.com

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20021 Baranzate (Mi), Italy
Tel: +39 02 383 41 51
Fax: +39 02 383 06 118
www.lpe-epi.com
ETC (Epitaxial Technology Center) developed and customized a SiC process for LPE ACiS M8 and ACiS M10 systems in order to perform the full range of epitaxial layers required for high-power and high-frequency applications, with low cost of ownership.

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Fax: +39 02 383 06 118
www.lpe-epi.com
LPE is a world leading Epitaxial Technology Company. Based on its silicon epitaxial reactor experience, LPE provides state-of-the-art SiC epitaxial reactors. Two systems are available: ACiS M8 and ACiS M10.

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Fax: +1 952 934 2737
www.svta.com

Veeco Instruments Inc
100 Sunnyside Blvd.,
Woodbury, NY 11797, USA
Tel: +1 516 677 0200
Fax: +1 516 714 1231
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7 Wafer processing materials

Air Products and Chemicals Inc
7201 Hamilton Blvd.,
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USA
Tel: +1 610 481 4911
www.airproducts.com/compound

MicroChem Corp
1254 Chestnut St. Newton,
MA 02464, USA
Tel: +1 617 965 5511
Fax: +1 617 965 5818
E-mail: sales@microchem.com
www.microchem.com

Power + Energy Inc
(see section 8 for full contact details)

Praxair Electronics
(see section 5 for full contact details)

8 Wafer processing equipment

EV Group
DI Erich Thallner Strasse 1,
St. Florian/Inn, 4782, Austria
Tel: +43 7712 5311 0
Fax: +43 7712 5311 4600
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Fax: +44 (0) 1389 879 042
www.logitech.uk.com
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Oerlikon Wafer Processing
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St. Petersburg, FL 33716,
USA
Tel: +1 727 577 4999
Fax: +1 727 577 3923
www.oerlikonoc.com

Oxford Instruments Plasma Technology
(see section 6 for full contact details)

Power + Energy Inc
(see section 8 for full contact details)

SAMCO International Inc
532 Weddell Drive, Sunnyvale, CA,
USA
Tel: +1 408 734 0459
Fax: +1 408 734 0961
www.samcointl.com

Surface Technology Systems plc
Imperial Park, Newport NP10 8UJ,
Wales, UK
Tel: +44 (0)1633 652400
Fax: +44 (0)1633 652405
www.stsystems.com
A leading manufacturer of plasma etch and deposition equipment, including DRIE, ICP, RIE & PECVD technologies used in the fabrication and packaging of semiconductor devices.

Synova SA
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Switzerland
Tel: +41 21 694 35 00
Fax: +41 21 694 35 01
www.synova.ch

Tegal Corp
2201 S McDowell Boulevard,
Petaluma, CA 94954, USA
Tel: +1 707 763 5600
www.tegal.com

Veeco Instruments Inc
(see section 6 for full contact details)

9 Materials & metals

Goodfellow Cambridge Ltd
Ermine Business Park, Huntingdon,
Cambridgeshire PE29 6WR, UK
Tel: +44 (0) 1480 424800
Fax: +44 (0) 1480 424900
www.goodfellow.com
Goodfellow supplies small quantities of metals and materials for research, development, prototyping and specialised manufacturing operations.

10 Gas and liquid handling equipment

Air Products and Chemicals Inc
(see section 7 for full contact details)

Cambridge Fluid Systems
12 Trafalgar Way, Bar Hill,
Cambridge CB3 8SQ, UK
Tel: +44 (0)1954 786800
Fax: +44 (0)1954 786818
www.cambridge-fluid.com

CS CLEAN SYSTEMS AG
Fraunhoferstrasse 4,
Ismaning, 85737,
Germany
Tel: +49 89 96 24 00 0
Fax: +49 89 96 24 00 122
www.cscleansystems.com

EMF Semiconductor Systems Ltd
(see section 6 for full contact details)

IEM Technologies Ltd
Fothergill House, Colley Lane,
Bridgwater, Somerset TA6 5JJ,
UK
Tel: +44 (0)1278 420555
Fax: +44 (0)1278 420666
www.iemtec.com

Power + Energy Inc
106 Railroad Drive,
Ivyland, PA 18974, USA
Tel: +1 215 942-4600
Fax: +1 215 942-9300
www.powerandenergy.com

SAES Pure Gas Inc
4175 Santa Fe Road,
San Luis Obispo, CA 93401, USA
Tel: +1 805 541 9299
Fax: +1 805 541 9399
www.saesgetters.com

11 Process monitoring and control

EMF Semiconductor Systems Ltd
(see section 6 for full contact details)

k-Space Associates Inc
3626 W. Liberty Rd.,
Ann Arbor, MI 48103,
USA
Tel: +1 734 668 4644
Fax: +1 734 668 4663
www.k-space.com

LayTec GmbH
Helmholtzstr. 13-14, Berlin, 10587
Germany
Tel: +49 30 39 800 80 0
Fax: +49 30 3180 8237
www.laytec.de

Optical Reference Systems Ltd
OpTIC Technium, St Asaph
Business Park, St Asaph, LL17 0JD,
UK

Tel: +44 (0)1745 535 188
Fax: +44 (0)1745 535 186
www.ors-ltd.com

WEP (Ingenieurbüro Wolff für Elektronik- und Programmentwicklungen)
Bregstrasse 90, D-78120
Furtwangen im Schwarzwald,
Germany
Tel: +49 7723 9197 0
Fax: +49 7723 9197 22
www.wepcontrol.com

12 Inspection equipment

Bruker AXS GmbH
Oestliche Rheinbrueckenstrasse 49,
Karlsruhe, 76187, Germany
Tel: +49 (0)721 595 2888
Fax: +49 (0)721 595 4587
www.bruker-axs.de

KLA-Tencor
160 Rio Robles, Suite 103D,
San Jose, CA 94538-7306, USA
Tel: +1 408 875 3000
Fax: +1 510 456 2498
www.kla-tencor.com

13 Characterization equipment

J.A. Woollam Co. Inc.
645 M Street Suite 102,
Lincoln, NE 68508, USA
Tel: +1 402 477 7501
Fax: +1 402 477 8214
www.jawoollam.com

Lake Shore Cryotronics Inc
575 McCorkle Boulevard,
Westerville, OH 43082, USA
Tel: +1 614 891 2244
Fax: +1 614 818 1600
www.lakeshore.com

14 Chip test equipment

Keithley Instruments Inc
28775 Aurora Road,
Cleveland, OH 44139,
USA
Tel: +1 440.248.0400
Fax: +1 440.248.6168
www.keithley.com

SUSS MicroTec Test Systems
228 Suss Drive, Waterbury Center,
VT 05677, USA
Tel: +1 800 685 7877
Fax: +1 802 244 7853
www.suss.com

15 Assembly/packaging materials

ePAK International Inc
4926 Spicewood Springs Road,
Austin, TX 78759, USA
Tel: +1 512 231 8083
Fax: +1 512 231 8183
www.epak.com

Gel-Pak
31398 Huntwood Avenue,
Hayward, CA 94544, USA
Tel: +1 510 576 2220
Fax: +1 510 576 2282
www.gelpak.com

Williams Advanced Materials
2978 Main Street,
Buffalo, NY 14214, USA
Tel: +1 716 837 1000
Fax: +1 716 833 2926
www.williams-adv.com

16 Assembly/packaging equipment

Ismeca Europe Semiconductor SA
Helvetie 283,
La Chaux-de-Fonds, 2301,
Switzerland
Tel: +41 329257111
Fax: +41 329257115
www.ismeca.com

J P Sercel Associates Inc
220 Hackett Hill Road,
Manchester, NH 03102, USA
Tel: +1 603 518 3200
Fax: +1 603 518 3298
www.jpsalaser.com

Kulicke & Soffa Industries
1005 Virginia Drive,
Fort Washington, PA 19034,
USA
Tel: +1 215 784 6000
Fax: +1 215 784 6001
www.kns.com

Palomar Technologies Inc
2728 Loker Avenue West,
Carlsbad, CA 92010,
USA
Tel: +1 760 931 3600
Fax: +1 760 931 5191
www.PalomarTechnologies.com

17 Assembly/packaging foundry

Quik-Pak
10987 Via Frontera,
San Diego, CA 92127,
USA
Tel: +1 858 674 4676
Fax: +1 8586 74 4681
www.quikicpak.com

18 Chip foundry

Compound Semiconductor Technologies Ltd
Block 7, Kelvin Campus,
West of Scotland, Glasgow,
Scotland G20 0TH, UK
Tel: +44 141 579 3000
Fax: +44 141 579 3040
www.compoundsemi.co.uk

United Monolithic Semiconductors
Route departementale 128,
BP46, Orsay, 91401,
France
Tel: +33 1 69 33 04 72
Fax: +33 169 33 02 92
www.ums-gaas.com

19 Facility equipment

MEI, LLC
3474 18th Avenue SE,
Albany, OR 97322-7014, USA
Tel: +1 541 917 3626
Fax: +1 541 917 3623
www.marlerenterprises.net

20 Facility consumables

W.L. Gore & Associates
401 Airport Rd,
Elkton, MD 21921-4236, USA
Tel: +1 410 392 4440
Fax: +1 410 506 8749
www.gore.com

21 Computer hardware & software

Ansoft Corp
4 Station Square, Suite 200,
Pittsburgh, PA 15219,
USA
Tel: +1 412 261 3200
Fax: +1 412 471 9427
www.ansoft.com

Crosslight Software Inc
121-3989 Henning Dr.,
Burnaby, BC,
V5C 6P8,
Canada
Tel: +1 604 320 1704
Fax: +1 604 320 1734
www.crosslight.com

Semiconductor Technology Research Inc
10404 Patterson Ave., Suite 108,
Richmond,
VA 23238,
USA
Tel: +1 804 740 8314
Fax: +1 804 740 3814
www.semitech.us

22 Used equipment

Class One Equipment Inc
5302 Snapfinger Woods Drive,
Decatur,
GA 30035,
USA
Tel: +1 770 808 8708
Fax: +1 770 808 8308
www.ClassOneEquipment.com
ClassOne Equipment specializes in buying and selling high quality reconditioned equipment to the Semiconductor and Nanotechnology Industries.

23 Services

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UK
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Fax: +44 (0)20 7405 9772
www.henrybutcher.com

M+W Zander Holding AG
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Germany
Tel: +49 711 8804 1141
Fax: +49 711 8804 1950
www.mw-zander.com

24 Consulting

WSR Optical Device Solutions
P.O. Box 248, Flemington, NJ
08822, USA
Tel: +1 908 428 4986
www.wsr-ods.com

25 Resources

SEMI Global Headquarters
3081 Zanker Road,
San Jose, CA 95134, USA
Tel: +1 408 943 6900
Fax: +1 408 428 9600
www.semi.org

Yole Développement
45 rue Sainte Geneviève,
69006 Lyon, France
Tel: +33 472 83 01 86
www.yole.fr

event calendar

If you would like your event listed in *Semiconductor Today*'s Event Calendar, then please e-mail all details to the Editor at mark@semiconductor-today.com

6–8 October 2008
AHPSL 2008: 2nd Applications of High-Power Semiconductor Lasers conference & exhibit
San Diego, CA, USA
E-mail: amueller@intertechusa.com
www.ahpsl-conference.com

6–10 October 2008
IWN2008: 5th International Workshop on Nitride Semiconductors
Montreux, Switzerland
E-mail: iwn2008@epfl.ch
http://iwn2008.epfl.ch

7–8 October 2008
Photonic Integration: The Path To The Optical Future
Monterrey, CA, USA
E-mail: iams@oida.org
www.oida.org

7–8 October 2008
Taiwan International Photovoltaic Exhibition & Forum
Taipei, Taiwan
E-mail: pv@taitra.org.tw
www.pvtaiwan.com

7–9 October 2008
SEMICON Europa 2008
Stuttgart, Germany
E-mail: ljaeth@semi.org
www.semiconeuropa.org

8–9 October 2008
CSP & CPV Investment & Finance Summit '08
Madrid, Spain
E-mail: belen@csptoday.com
www.csptoday.com/eufinance

12–15 October 2008
IEEE Compound Semiconductor IC Symposium 2008 (2008 CSIC Symposium) including the 23rd annual Reliability of Compound Semiconductors (ROCS) Workshop
Monterey, CA, USA
E-mail: s.kingston@ieee.org
www.csics.org

13–17 October 2008
Solar Power International '08 (formerly Solar Power 2008)
San Diego, CA, USA
E-mail: info@solarelectricpower.org
www.solarpowerconference.com

15–16 October 2008
Photonex 2008
Coventry, UK
E-mail: info@photonex.org
www.photonex.org

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16–17 October 2008
LED Japan/Strategies in Light
Tokyo, Japan
E-mail: tcarli@strategies-u.com
http://sil08.events.pennnet.com

26–30 October 2008
Asia-Pacific Optical Communications (APOC)
Zhejiang, Hangzhou, China
E-mail: spie@spie.org
www.apoc2008.org

27–31 October 2008
11th European Microwave Week (EuMW2008)
Amsterdam, The Netherlands
E-mail: marc.vanheijningen@tno.nl
www.eumweek.com

6 November 2008
SPIE Photonics Innovation Summit 2008
San Francisco, CA, USA
E-mail: CustomerService@SPIE.org
http://spie.org/innovation.xml

19–20 November 2008
Optoelectronics Industry Development Association's 17th Annual Forum
Baltimore, MD, USA
E-mail: iams@oida.org
www.oida.org

1–5 December 2008
MRS Fall Meeting 2008
Boston, MA, USA
E-mail: info@mrs.org
www.mrs.org

3–5 December 2008
Semicon Japan
Chiba, Japan
E-mail: jeventinfo@semi.org
www.semiconjapan.org

11–13 December 2008
IEEE 39th Semiconductor Interface Specialists Conference (SISC 2008)
San Diego, CA, USA
Abstract deadline: 15 July 2008
E-mail: kaczer@ieeesisc.org
www.ieeesisc.org

13–17 December 2008
Photonics 2008: 9th International Conference on Fiber Optics and Photonics
New Delhi, India
E-mail: bppal@physics.iitd.ac.in
http://web.iitd.ac.in/~photonics2008

14–17 December 2008
IEEE International Electron Devices Meeting (IEDM 2008)
San Francisco, CA, USA
E-mail: iedm@his.com
www.ieee.org/conference/iedm

9–11 January 2009
LED EXPO (India)
New Delhi, India
E-mail: info@theledexpo.com
http://theledexpo.com

20–22 January 2009
SEMICON Korea 2009
Seoul, South Korea
E-mail: hkim@semi.org
www.semiconkorea.org

24–29 January 2009
SPIE Photonics West 2009
San Jose, CA, USA
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http://spie.org/photonics-west.xml

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