InP wafer market growing at 14% CAGR from $77m in 2018 to $172m in 2024

Market dominated by fiber communications, with datacoms outgrowing telecoms.

The indium phosphide (InP) wafer market is rising at a compound annual growth rate (CAGR) of 14% from $77m in 2018 to $172m in 2024, according to market research and strategy consulting firm Yole Développement in the report 'InP Wafer and Epiwafer Market - Photonic and RF Applications 2019'.

As an old but still gold-standard member of the compound semiconductor family, InP possesses the key advantage of being capable of light emission and detection at wavelengths above 1000nm. The InP wafer market is hence largely impacted by photonics applications and is dominated by the high-speed fiber-optic communication market for datacoms and telecoms, with each segment using InP as a substrate for both laser diodes and photodiodes in optical transceivers.

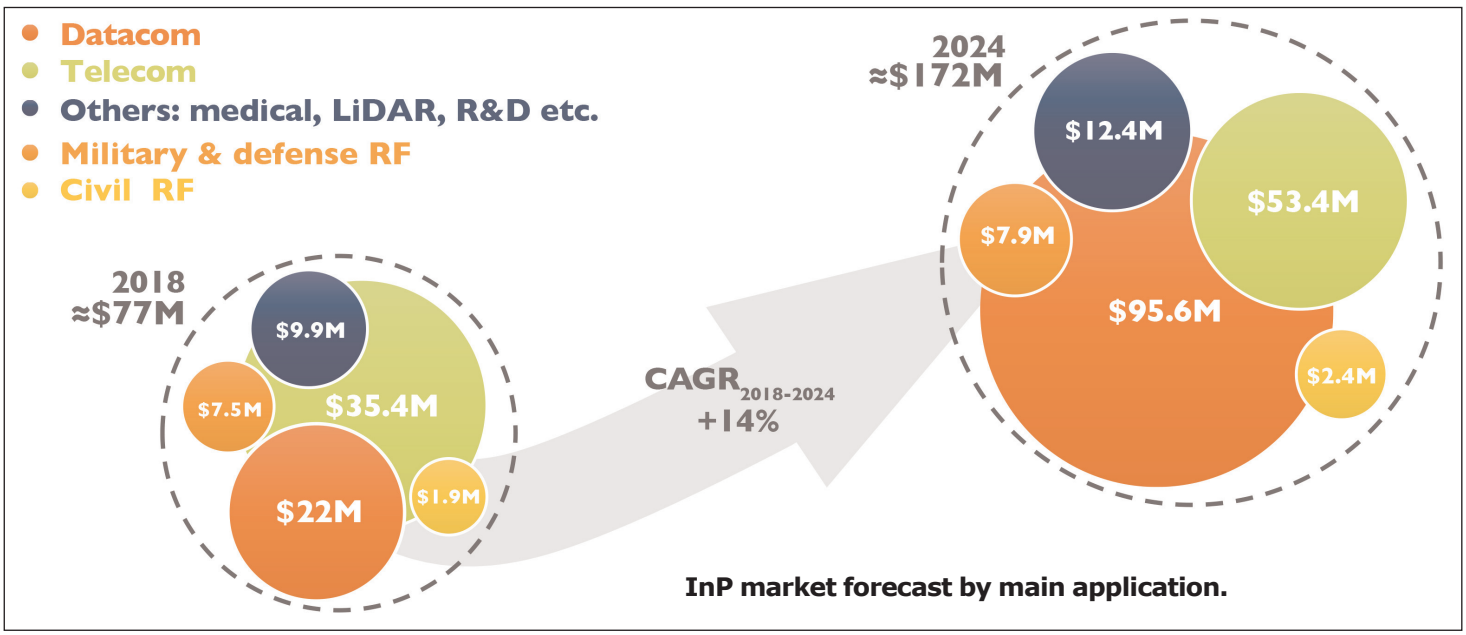
Most recently, driven by the arrival of 5G and the impressive growth in datacoms, the InP wafer and epiwafer market is showing strong growth.

In addition to the photonics domain, InP is also attractive for high-speed and low-noise performance in high-frequency RF applications. "Though it is often overshadowed by rivals like gallium arsenide (GaAs) and silicon germanium (SiGe) for mass-volume, cost-driven RF applications, InP remains a top choice for performance-driven niche markets like military communication, radar and radiometry as well as automatic test equipment," says Ezgi Dogmus PhD, technology & market analyst in Yole's Power & Wireless team. "Moreover, different industrial actors including Skyworks, GCS and IntelliEPI are monitoring InP technology for the upcoming 5G move," she adds.

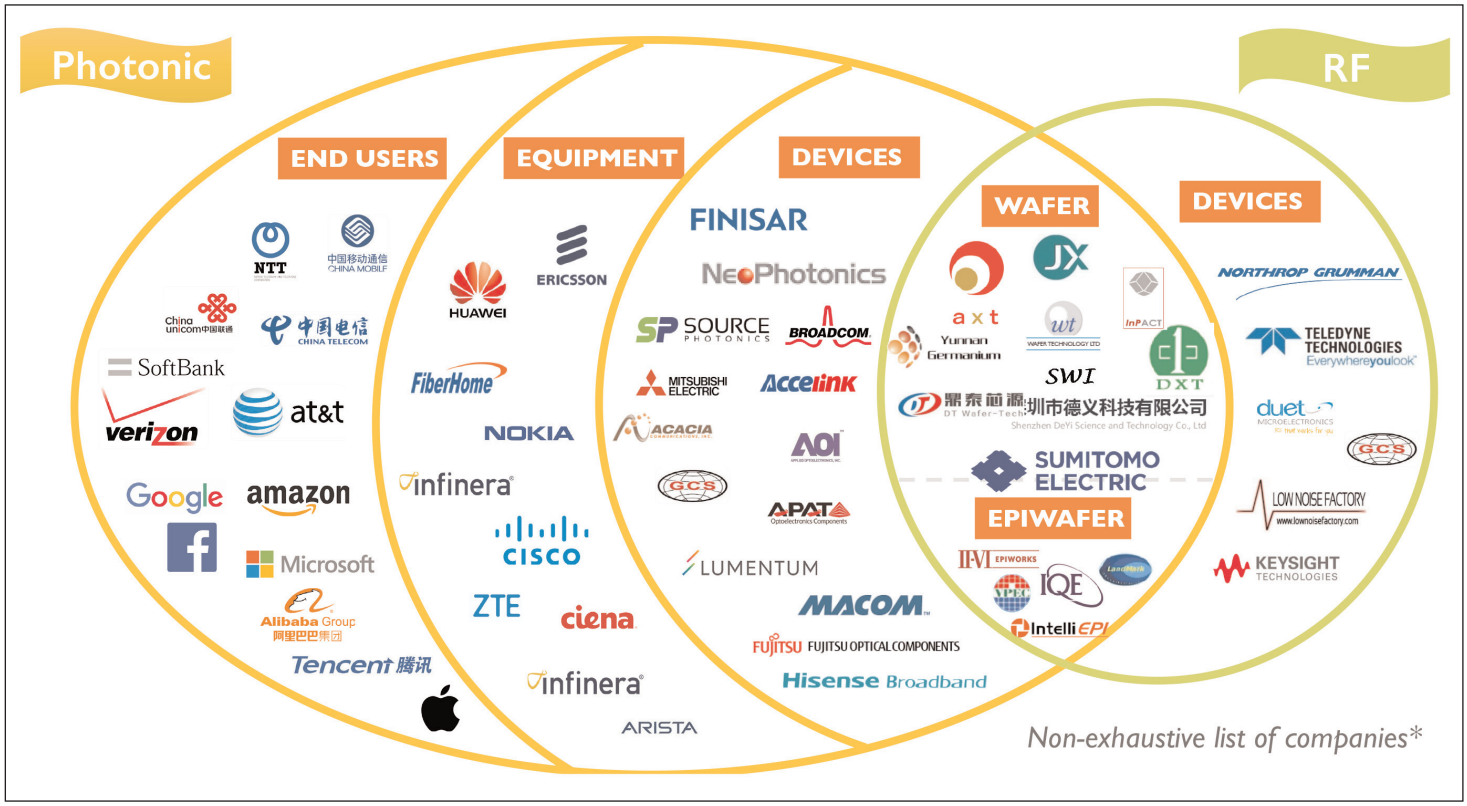
Currently, the real boost for the InP wafer market is expected in photonic applications. In optical communications, InP offers high performance in many functions including emission, photodetection, modulation and mixing, but it is often challenged by other semiconductor platforms because of its high cost. Nevertheless, InP is an indispensable building block for laser diodes in transceivers used for telecom and datacom applications.

With the requirement of more data transfer at higher speeds, transceiver technology is migrating to technology that offers higher rates (100GbE and 400GbE), for which InP is more favorable. The wafer market for datacoms applications is expected to explode, growing at a CAGR of 14% from $22m in 2018 to $95.6m in 2024.

Specific to the cyclical telecom market, which has recently slowed down, massive investment plans from



InP market forecast by main application.



InP market supply chain overview.

various operators (e.g. China Telecom) are expected with the advent of 5G networks. "In fact, the InP wafer market for telecom is projected to reach around $53.4m by 2024 [up from $35.4m in 2018]," says Hong Lin PhD, senior technology & market analyst. Also, significant investment in the datacom market is expected from different players, led by Internet giants Google, Amazon, Alibaba and more.

Yole expects growth in military & defense RF applications between 2018 and 2024 from $7.5m to $7.9m, and in civil RF applications from $1.9m to $2.4m.

Last but not least, other applications (e.g. LiDAR, R&D etc) are expected to grow from $9.9m in 2018 to $12.4m in 2024. Light detection & ranging (LiDAR) applications could be particularly promising for InP, i.e. enabling eye safety at higher wavelengths, which is currently in an early R&D phase.

Many players at the device level, and high concentration at the epi & wafer levels

The InP industry has various business models and numerous players. It is worth noting that, from wafer to device manufacturing, the concentration of market players varies.

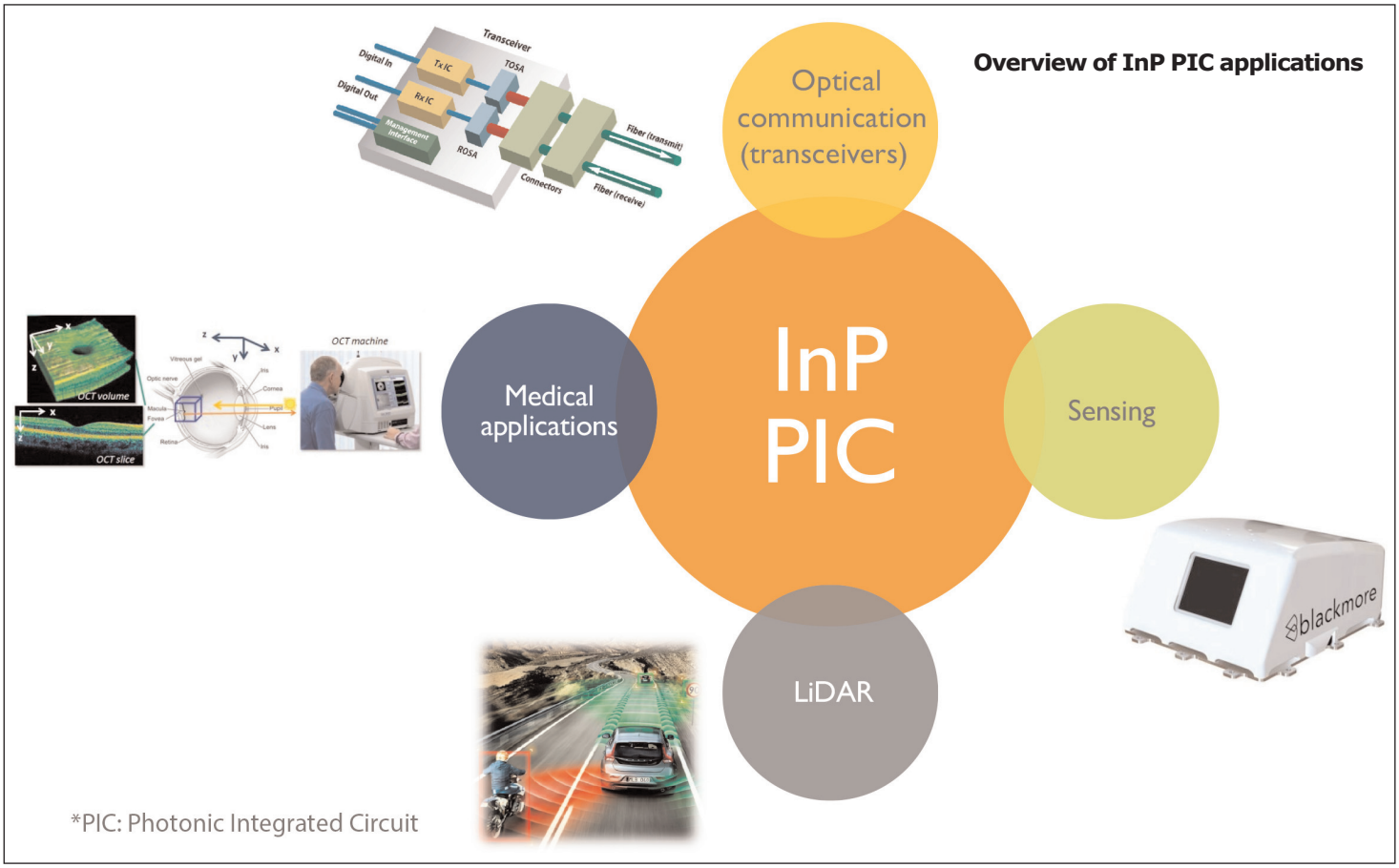
At the device level, Yole has identified more than 30 InP foundries and integrated fabs, most of which are currently focused on photonic chips. InP fabs are found globally, from the USA to Europe and Asia. Most players are integrated fabs manufacturing for their own products. These fabs have their own epiwafer production capacity or R&D capability, along with an outsourcing division for their epiwafers. There are also InP fabs that purchase epiwafers on the open market. Yole does not expect the outsourcing ratio to evolve quickly in the coming years.

In contrast to the device manufacturing arena, the epiwafer open market is highly concentrated. The leader is Landmark Optoelectronics, which is focused on photonic applications. Epiwafer foundry IQE also plays a key role, with products spanning photonics and RF applications.

The wafer-level segment mirrors the epiwafer market in terms of concentration. More than 80% of the market is held by two firms: Sumitomo Electric Industries (SEI) and AXT Inc. JX Nippon Group occupies third place in terms of wafer sales. Other players are either in pilot-line production and only delivering small wafer volumes or still in the R&D stages.

Future for InP-based PICs if challenged by silicon photonics?

Since photonic integrated circuits (PICs) were first introduced in 1969, different platforms like InP, silicon photonics and polymer have been studied and developed. InP-based PICs have been widely studied, since they allow emission at wavelengths >1000nm, corresponding to several windows of optical fibers as well as being necessary for some other applications. In discussion with industry players about market data, Yole's analysts found that there are questions concerning the definition of monolithic InP PICs. In the extreme, electro-absorption modulated lasers (EMLs) are



already monolithic. In fact, it all depends on the level of integration. Although different building blocks (passive components, polarization components, phase modulator, laser, detector and others) have been demonstrated using InP, commercially available, fully integrated InP products are still limited.

In recent years, InP PICs have faced strong competition from silicon photonics, in which industrial players like Intel have invested heavily. Indeed, comparing silicon photonics and InP PICs, it is hard to dispute that — due to large, higher-quality silicon wafers — silicon photonics have a cost advantage for large-volume applications.

But, although InP has faced (and will continue to face) strong competition from other materials for photonic applications, its direct bandgap makes it unique for laser diode applications. Yole therefore believes that InP laser devices will prevail for a long time, at least for active optoelectronic devices. Moreover, InP PICs make sense for small-volume markets, reckons the firm, addressing diverse applications such as medical, high-end LiDAR and sensing, as well as optical communications. Players in these areas are likely to capitalize on the existing telecom/datacom supply chain for ramp-up, Yole concludes. ■

www.yole.fr/InP_Wafer_Epiwafer_MarketStatus.aspx