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InP and GaAs Photonics for AI: Global Market 2027-2037

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Abstracts

Indium phosphide (InP) and gallium arsenide (GaAs) have moved from specialist telecom materials to strategic infrastructure for artificial intelligence. Silicon cannot emit light efficiently, so every optical link in an AI cluster depends on a compound-semiconductor laser. That holds even when the rest of the link is built on silicon photonics. As each new generation of GPU and accelerator doubles its I/O bandwidth, and copper runs out of reach at 200 Gb/s per lane, demand for InP lasers, photodiodes and modulators has outpaced supply at every level of the chain. Recent developments show how acute the bottleneck has become:

Shortages: through 2025 and 2026, leading suppliers reported EML laser under-shipment of more than 30% and capacity sold out into 2027–2028.

Substrate supply: InP substrate prices rose repeatedly after China introduced export licensing for InP and indium compounds in February 2025.

Customer funding: NVIDIA took strategic stakes in Lumentum and Coherent, and hyperscalers are now prepaying for laser capacity.

Substrate expansion: AXT, Sumitomo Electric and JX Advanced Metals have announced multi-fold capacity increases.

Wafer-fab expansion: Coherent, Lumentum, Nokia and an EU-backed consortium in Eindhoven are scaling 6-inch InP fabs. The move from 3-inch and 4-inch wafers has become the industry’s central cost lever.

Chinese suppliers: Yuanjie, Everbright, Vertilite and Source Photonics are

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investing heavily to localise high-speed laser chips.

The product mix is also changing quickly. 200G-per-lane EMLs entered volume production, and 400G-per-lane devices were demonstrated at OFC 2026. The fastest growth is shifting to high-power and ultra-high-power CW lasers that feed silicon photonics and co-packaged optics (CPO) through external laser sources. Multi-wavelength DWDM sources for optical I/O in scale-up networks are growing fast as well. In GaAs, 200G VCSELs and dense VCSEL arrays for “slow-and-wide” in-rack links are opening new opportunities. Quantum-dot comb lasers on GaAs are emerging as an alternative light source. Venture investment in CPO, optical I/O and multi-wavelength laser start-ups has reached record levels. Looking ahead, supply is expected to reach approximate balance around 2028–2029, after which competition will shift from capacity to cost. Several factors will decide the winners:

6-inch yields: how quickly substrate makers and device fabs master 6-inch production.

Laser reliability: how reliably ultra-high-power lasers perform inside switches and accelerator packages.

Integration: how far heterogeneous and transfer-printed lasers are integrated with silicon photonics.

Competing modulators: thin-film lithium niobate and other new modulators will convert demand for modulated lasers into demand for CW lasers.

Geopolitics: export controls on gallium, indium and InP will remain a permanent design constraint.

As AI scale-up domains move to optics between 2027 and 2030, InP’s role will grow. Value will move from pluggable transceivers into the rack, the package and, ultimately, the accelerator itself.

InP and GaAs Photonics for AI: Global Market 2027–2037 is a comprehensive analysis of the compound-semiconductor devices, epitaxial wafers and substrates that power optical interconnect in AI data centres. It covers the market from substrate to bare die. It quantifies the lasers, photodiodes, modulators and amplifiers that sit inside pluggable

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transceivers, linear-drive optics, co-packaged optics and optical I/O, and the InP and GaAs wafers they are built on. The AI build-out has made optical components one of the tightest bottlenecks in computing infrastructure. Every silicon-photonics engine depends on an InP light source. Supply of high-speed EMLs, high-power CW lasers and device-grade InP substrates has fallen well short of demand. The report explains why: crystal-growth yields, the move from 3-inch to 6-inch wafers, MOCVD and test capacity, and Chinese export controls on indium and gallium compounds. It also sets out how the industry is responding, through fab acquisitions, multi-fold substrate expansions, customer prepayments and NVIDIA's direct investment in laser suppliers.

Forecasts run from 2021 to 2037 and are segmented as follows:

Device technology: EML, DML, standard CW and ultra-high-power CW lasers, DWDM and multi-wavelength sources, tunable lasers, InP IQ modulators and coherent PICs, SOAs, InP and GaAs photodiodes, VCSELs and quantum-dot sources.

Material: InP and GaAs.

Network architecture: scale-out, scale-up, and scale-across/DCI.

Value-chain level: bare die, captive and open-market epiwafers, and substrates by wafer diameter.

Region: region of manufacture.

Units, average selling prices and revenues are given for each segment, along with base, upside and downside scenarios. The report assesses technology roadmaps from 100G to 400G per lane and beyond. It covers integration routes with silicon photonics (external laser sources, hybrid flip-chip, heterogeneous bonding, micro-transfer printing and monolithic quantum-dot growth) and the competitive threat from thin-film lithium niobate, ferroelectric and microLED alternatives. Supply-chain chapters map substrate, epitaxy, device and foundry capacity, compare net sellable capacity with demand, and track lead times, pricing, investment, M&A, government programmes and venture funding.

The report closes with 65 detailed company profiles spanning substrate suppliers, epiwafer houses, equipment makers, device manufacturers, foundries, integration-

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platform developers, start-ups and the system companies driving demand. A companion Excel workbook provides the full forecast data with an interactive dashboard.

Report contents include:

Executive summary with key findings, scenario summary and recent developments for 2025–2026

Scope, methodology, and material properties of InP, GaAs, silicon and GaN

AI demand drivers: scale-up, scale-out and scale-across networks, reach versus technology, the lane-rate roadmap, and laser content per link

InP device technologies: EML, DML, CW and UHP CW lasers, DWDM sources, tunable lasers, IQ modulators, SOAs, photodiodes and InP PICs

GaAs device technologies: 850 nm VCSELs, VCSEL arrays for scale-up, GaAs photodiodes and quantum-dot lasers

Integration with silicon photonics and competing modulator platforms

Substrate, wafer-diameter and epitaxy technology, including VGF/VB growth, the 6-inch transition and MOCVD

Market forecasts for 2021–2037 by device, material, architecture, epiwafer, substrate and region, with scenarios

Supply chain and capacity: suppliers, capacity versus demand, lead times, pricing and geographic footprint

Investment, M&A, government programmes and start-up venture funding

China, critical minerals and export controls

Competitive landscape and market shares

Technology roadmap, opportunity assessment and outlook

65 company profiles including Accelink Technologies, Aixtron, ams OSRAM,

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Applied Optoelectronics, Avicena, AXT Inc., Ayar Labs, Broadcom, Coherent Corp., DOWA Electronics Materials, EFFECT Photonics, Enlightra, Eoptolink, Everbright Photonics, Freiberger Compound Materials, Furukawa FITEL Optical Components (formerly Fujitsu Optical Components), GCS (Global Communication Semiconductors), HiSilicon, HyperLight, Innolume, Intel, IntelliEPI, iPronics, IQE, JX Advanced Metals, Korea Zinc, LandMark Optoelectronics, Lightmatter, Lumentum, Lumilens and more.....

Each company profile includes a key-facts panel (founding, headquarters, ownership, leadership, revenue or funding, and AI photonics products), a company description, products and technology, dated recent developments for 2025–2026, a financial, funding or product table where available, a Future Markets view of the company’s strategic position, competitive context and key partners, and the company website.

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