Press Release

InP on SiN Photonic integrated circuits realized through wafer-scale micro-transfer printing

Eindhoven, June 2025 – After 51 months of intensive research and development, the Horizon 2020 project **INSPIRE** (InP on SiN Photonic Integrated Circuits Realized through Wafer-Scale Micro-Transfer Printing) successfully concludes, having laid the foundations for a new generation of high-performance **photonic integrated circuits (PICs)**. The project demonstrated the feasibility of combining the best active optoelectronic components based on indium phosphide (InP) with the ultra-low-loss passive functionalities of silicon nitride (SiN) – enabled by **wafer-scale micro-transfer printing (MTP)**.

Pushing the Limits of Integrated Photonics

INSPIRE addressed a critical limitation of current photonic platforms: the trade-off between performance and integration. Through MTP, INSPIRE successfully integrated state-of-the-art lasers, modulators, and photodetectors with SiN-based passive waveguides, combining ultra-low loss (<5 dB/m) with high-performance active functionality on a single chip.

Key technological breakthroughs include:

- A **low-noise hybrid laser** with <10-kHz linewidth and 20-GHz chirp span, enabling sub-centimeter resolution in distributed acoustic sensing (DAS);
- Proof-of-concept **SOA-gated switch matrix prototypes** up to 16×16 for next-generation data center switch fabrics;
- Progress toward **microwave photonic systems**, with potential applications in LiDAR, optical communication, and RF photonic signal processing.
- Wafer scale printing of devices with printing yield and placement accuracy withing target requirements of 99% and +/-1 um, respectively.

Demonstrated Industrial Potential

While final demonstrator systems are yet to be completed after the project timeline, **key building blocks were validated** and benchmarked against commercial solutions, notably for coherent sensing and switching applications. For instance, the INSPIRE laser outperformed conventional semiconductor devices in critical sensing metrics, while maintaining scalability and integration compatibility.

INSPIRE showed significant reduction in **SWaP (Size, Weight, and Power)** – with sensor systems projected to shrink from >10L to <0.5L – without compromising performance. The

technology is considered **nearly ready for industrial adoption**, particularly in sensing applications with a short time-to-market horizon (<5 years).

Building Europe's PIC Supply Chain

INSPIRE laid the groundwork for a robust European supply chain:

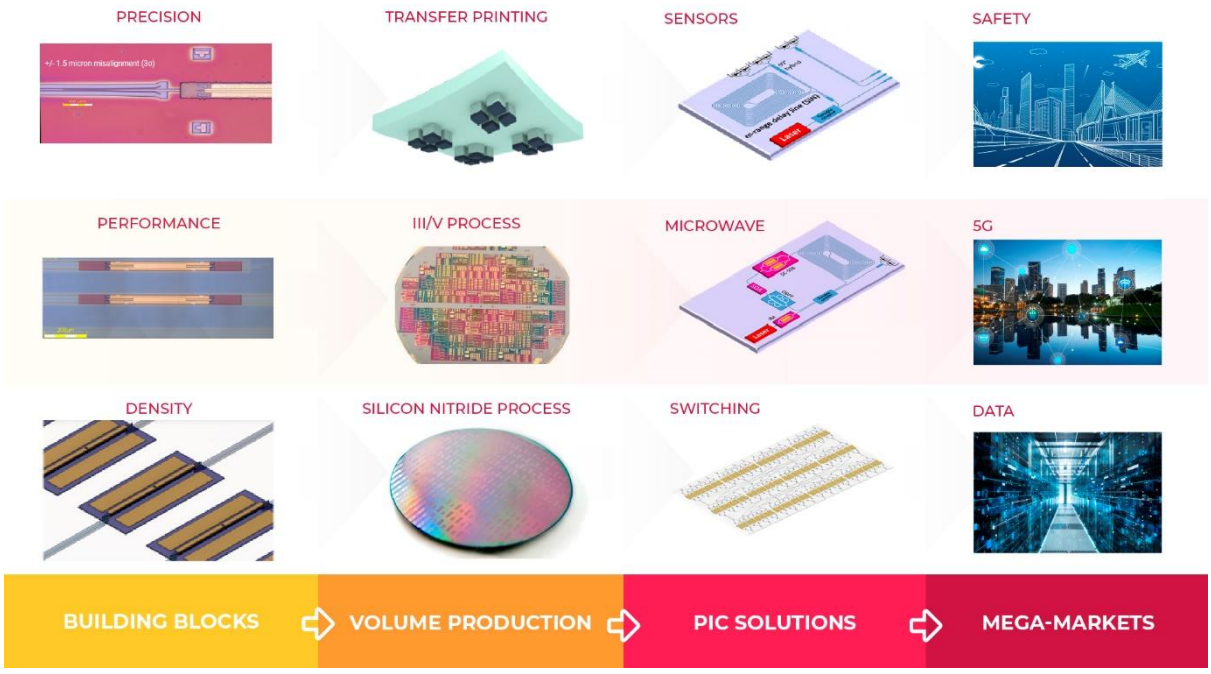
- The passive Si/SiN PIC platform, developed at imec, is now at **TRL7**;
- The III-V "coupon" technology was successfully transferred to **SMART Photonics**, enabling scalable and high-TRL MTP integration;
- **X-Celeprint** advanced MTP standardization and ecosystem development, involving over 50 active suppliers and 100+ prospective partners.

These results feed directly into ongoing EU initiatives, such as **PhotonixFAB**, **PIXEurope**, and **LightUP**, aiming to create **pilot lines and production-grade capabilities** across Europe.

"INSPIRE has demonstrated that hybrid integration via micro-transfer printing is not only technically viable, but also scalable and compatible with industrial manufacturing. This paves the way for cost-effective, high-performance photonic systems in sensing, datacom, and RF domains," said project coordinator **Prof. Martijn Heck** from Eindhoven University of Technology.

A Platform for the Future

Beyond the selected demonstrators, the INSPIRE technology platform shows great promise in a wide array of applications: **LiDAR, free-space communications, quantum technology, neuromorphic and optical computing**, and more. With major building blocks in place and the industrial supply chain maturing, the INSPIRE platform positions Europe at the forefront of next-generation integrated photonics.



INSPIRE in overview connecting building block innovation to high-growth markets

Project consortium INSPIRE:

Project duration: 1st of January 2021 – 30th of June 2024

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