PZT and Graphene MATerials innovations for advanced opto-Electronic applications in AR and biosensing

MatEl

Project ambition:

MatEl builds upon advanced materials and beyond the state-of-the-art digital processing technologies to enable new integration schemes fostering the wide adoption of **hybrid OEICs** (optoelectronic integrated circuits) **to industrial and biomedical applications**.

Project description:

Silicon nitride (Si_3N_4) is a promising candidate for optoelectronics applications; next to silicon photonics and indium phosphide, Si_3N_4 photonic integrated circuits have broad spectral coverage and low propagation losses. Still, Si_3N_4 itself has no active effect (except thermal tuning) and active functionality can be demonstrated either by integrating active components or active materials. The on-chip integration of III-V and II-VI semiconductors on Si_3N_4 is complicated and costly. The EU-funded project "MatEl" introduces a **novel, on-chip integration scheme** enabling accurate and **fast alignment and bonding** of any type of chip package on Si_3N_4. MatEl will combine **laser transfer and laser soldering** to demonstrate hybrid platforms, which will be enhanced by the **monolithic integration** of advanced materials – **graphene and high-quality PZT**.

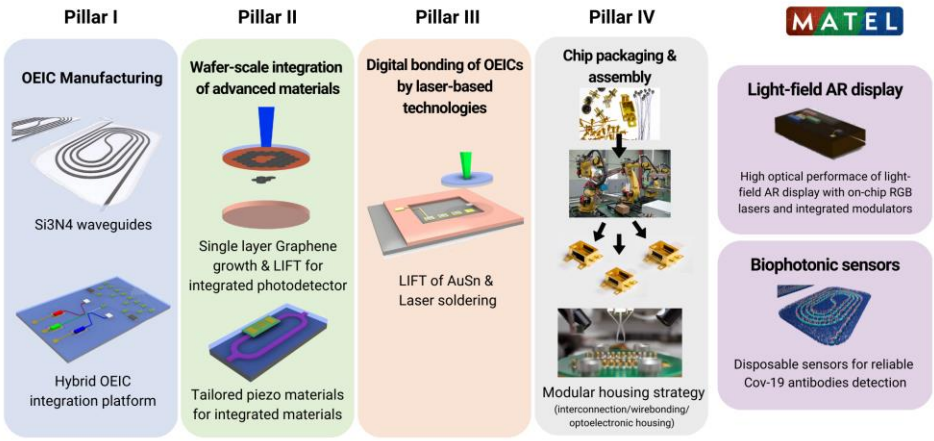

***Figure 1**: MatEl Concept*

The MatEl platform will combine the wide bandwidth and high confinement provided by Si_3N_4 with the active functionality of III-V and II-VI lasers, opening up a broad spectrum of **next-gen applications,** which will accelerate the industrial adoption of hybrid OEICs - offering **high-performance, multi-functionality and cost efficiency** in a miniaturized footprint.

Project facts

Start date
01/01/2023

End date
30/06/2026

Duration in months
42

Project budget
€3.2M

HE Research and Innovation Action (RIA)

Grant Agreement
101091774

Call
HORIZON-CL4-2022-RESILIENCE-01

Topic
HORIZON-CL4-2022-RESILIENCE-01-10 - Innovative materials for advanced (nano)electronic components and systems (RIA)

Keywords

Optoelectronic and integrated circuits / laser digital integration / graphene detectors / PZT modulators

MatEl's innovative solution for selected applications highlights the universal character of the project's vision.

- **AR display** featuring a 2D light source for light-field with on-chip RGB lasers and OEIC-based demultiplexer.
- **Bio-photonic sensors** for reliable and low-cost detection of Covid-19 featuring integrated on-chip VCSEL at 850 nm and Graphene-based photodetector.

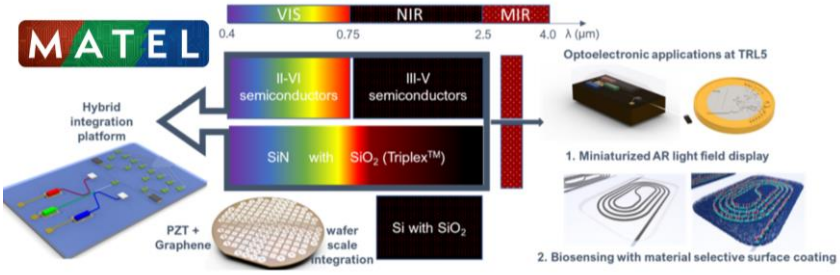

Figure 2: *MatEl's Applications*

Expected impact:

MatEl's vision of enabling multiple functionalities in a miniaturized footprint will pave the way for a broad spectrum of next-gen optoelectronic applications, strengthening the EU's photonics and microelectronics industrial capabilities.

- Next generation of OEIC-based devices: wide-bandwidth, minimized losses & multifunctionality in miniaturized form factors
- Lowering the barriers for OEIC uptake by high-tech SMEs
- Strengthening the EU's industrial capability in photonics and microelectronics
- European strategic autonomy in OEICs
- New employment positions in innovative SMEs
- Green and digital manufacturing approach fostering chemicals and waste minimization
- Improved quality of life and longevity of EU citizens

Consortium

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