CONSORTIUM

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NANOPHOTONICS TECHNOLOGY CENTER

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

IBM

PNO INNOVATION

Lumiphase

IBM Research Europe

Optalysys

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PHOENIX

Ferroelectric PHOtonics ENablIng novel functionalities and enhanced performance of neXt generation PICs

ABOUT THE PROJECT

In PHOENIX, "Ferroelectric PHOtonics ENablIng novel functionalities and enhanced performance of neXt generation PICs", funded by the EU Horizon Europe programme (GA 101070690), a consortium formed by Partners Lumiphase (CH), Optalysys (UK), IBM Research (CH and IL), Nanophotonics Technology Center - Universitat Politècnica de València (UPV) (ES), and PNO Innovation (ES), and the Institute of Physics of the Czech Academy of Sciences (FZU) (CZ), coordinated by KU Leuven (BE), have joined their forces to create building blocks for the next generation of encryption and computing hardware.

They will leverage compact photonic integrated circuits (PIC) offering a continuous and efficient control over optical signals. The PIC chips are based on Lumiphase's proprietary technology, and enhanced with novel functionalities using materials developed at KUL and UPV. Epitaxial technology will be advanced through the realization and upscaling of high-quality oxide thin-films.

36	8	6	~ 5,2
MONTHS	PARTNERS	COUNTRIES	MILL € BUDGET

OBJECTIVES

The developed technology will be used to demonstrate its benefits in four high-impact emerging applications:

1. fully homomorphic encryption (Optalysys, IBM Research)
2. 5G infrastructure (Optalysys)
3. inference of deep neural networks (IBM Research), and
4. training of deep neural networks (IBM Research).

IMPACT

The validation of the developed technologies will be completed with an extrapolation to benchmark against representative existing systems and a roadmap for photonic-electronic integration. The project will perform a market analysis and a techno-economic evaluation to define business models and exploitation plans that ensure the sustainability of the PHOENIX platform to reduce innovation-to market-time and R&I costs for disruptive high-tech SMEs and maximize the impact of the 4 user cases demonstrators.

RESULT AND OUTLOOK

In the first 30 months of the project we have screened and identified the requirements for material, device and hardware design for the demonstrators. Deposition of VOx on BTO surfaces, annealing and material characterization was performed to identify the process conditions for the manufacturing of hybrid VOx/BTO devices, while fabrication and optical characterization of waveguides was performed to identify the process conditions for the manufacturing of hybrid VOx/BTO devices. In addition, the PIC for the first multi-process-wafer round was released. We have been working on PIC design to manufacture the first chip demonstrator to validate basic functionalities using BTO technology, as well as to manufacture the first demonstrator as a photonic engine for deep neural network and for fully homomorphic encryption.

In the last 12 months of the project, we will perform calculations to determine the limits of the dielectric response in the PIC materials and perform ex-situ THz characterization of the dielectric losses. Ultimately, the full set-up of the use cases demonstrators will be built and evaluated.