NanoPhOtonic devices applying SElf-assembled colloIDs for novel ON-chip light sources

POSEIDON

Introduction:

Silicon photonics made tremendous progress in the last decade and promises far more cost effective photonic integrated circuits (PICs) than competing III-V semiconductors. However, a monolithically integrable, mass-manufacturable light source is missing. All approaches of heterogeneous integration of III-V light sources are costly and not highly scalable, creating massive cost and complexity barriers for the commercialization of PICs.

Project description:

The ground-breaking aim of POSEIDON is to develop a radically new bottom-up approach towards multi-scale, on chip self-assembly of active colloids based on low cost colloid technology. For the first time this encompasses the entire process chain of computer-aided design, controlled synthesis, hierarchical assembly, optoelectronic integration and device fabrication. By controlling and designing self-assembly processes directly on a device, addressing length scales from nm to 100's of µm simultaneously, the POSEIDON approach allows to fabricate functional nanophotonic components with 3D, single-nm resolution integrated into complex PICs.

The ambitious goal of POSEIDON is to develop electrically pumped light sources which can be monolithically integrated into the back end of CMOS chips. This breakthrough overcomes the limitations of top-down PIC fabrication and tears down the massive cost and complexity barriers initially mentioned.

Project facts:

Start date: 01/01/2020
End date: 31/12/2023

Duration in months: 48

Project EU funding: € 3.07M

H2020 FET-OPEN Research & Innovation Action
Grant Agreement no.: 861950

Call (part) identifier:
H2020-FETOPEN-2018-2020
(FET Open – Novel ideas for radically new technologies)

Topic:
FETOPEN-01-2018-2019-2020

Keywords:
nanophotonic,
self-assembly,
integration,
electrically pumped light sources,
colloids

Potential applications:

The short-term goal of POSEIDON is to fabricate a demonstrator on-chip light source for data transmission or sensing on a PIC. The mid-term goal after POSEIDON is the construction of lasers by coupling the emitters to nanophotonic resonators. The long-term vision of POSEIDON goes far beyond the creation of on-chip light sources. The aim is to create a manufacturing platform for generic PICs consisting of monolithically integrated active colloidal components (light sources and detectors), Si photonics and CMOS electronics.

The benefits of POSEDON can be quantum leaps in data center energy efficiency and network performance, enabled by the project targeting the usual Datacom wavelengths, and cheap yet powerful optical sensors.

Expected impact:

The market for conventional data centre networking equipment is expected to reach $32 billion by 2022 with a Compound Annual Growth Rate (CAGR) of 10.2 %. POSEIDON is set to disrupt this market by removing massive cost and complexity barriers for the integration of PICs with conventional CMOS circuits.

On-chip generation of visible and IR light integrated together with CMOS electronics will lay the foundation for cheap and energy efficient sensors driving industry 4.0 (e.g. for industrial process control, automotive, robotics, internet of things).

The project has the potential to transform Europe's industrial landscape and provide sustainable solutions to societal challenges across ICT, quantum technologies, energy, environment, health and security.

The project includes top EU innovation performers (researchers and companies) involved in modelling and simulation (UHULL, CSIC), colloid synthesis (USIEGEN, CIC), hierarchical assembly (FAU, UHULL), development of electrically pumped colloidal light sources (UHULL, UCAM, AMO), fabrication of PICs (AMO) and key innovation players (IBM, Hitachi, Mellanox, Causeway Sensors, Senseair) who are integrated into the project through an External Advisory Board for target specification and impact monitoring.

Consortium:

AMO	DE
AMI	CZ
UHULL	UK
USIEGEN	DE
FAU	DE
CIC biomaGUNE	ES
UCAM	UK
CSIC	ES

Contacts:

Project Coordinator:
Stephan Suckow
AMO GmbH (Germany)
suckow@amo.de

Project Manager:
Jana Mwangi
AMIRES s.r.o. (Czech Republic)
mwangij@amires.eu

Website:

www.poseidon-fet.eu

The project POSEIDON receives funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 861950.