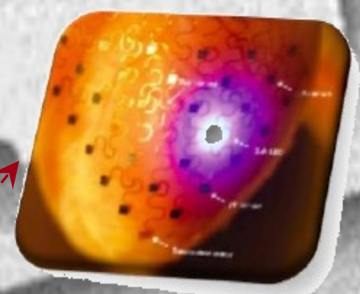
Pilot Line for Micro-Transfer-Printing of Functional Components on Wafer Level

Mission

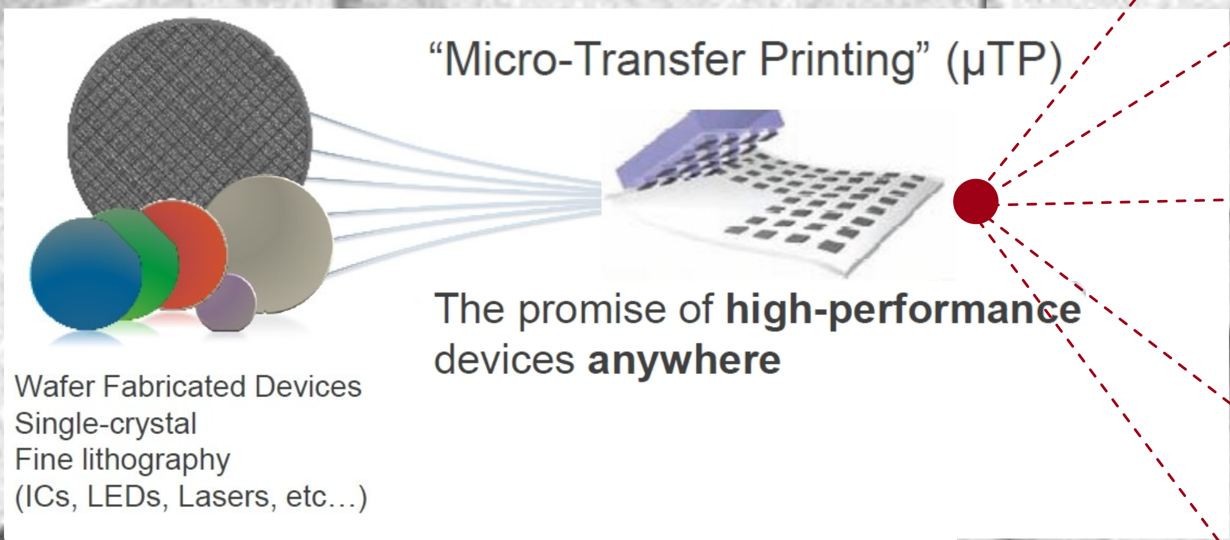
The MICROPRINCE project focuses on creation of a pilot line for heterogeneous integration of smart systems by micro-transfer-printing (µTP) in a semiconductor foundry manufacturing environment. Functional components like processed III/V devices, optical filters and special sensors will be transferred to target wafers to demonstrate the capabilities of the technology.



Goals

MICROPRINCE targets to reach the following goals:

- Transfer of the µTP-technology for microelectronics application from laboratory to an industrial environment for bridging the "Valley of Death" to industrialization
- Creation, installation and demonstration of a pilot line for µTP in a manufacturing environment for open access
- Development of design rules and its implementation in Process Design Kits (PDK)
- Technology demonstration for five defined target applications for magnetic and optical sensing and photonic systems
- Development of processes for heterogeneous system integration of CMOS and MEMS wafers
- Realization of printing processes on 200 (150) mm silicon wafers



Concept

Based on several EU and national research activities demonstrating successfully the feasibility of µTP technology in a scientific and laboratory environment, the MICROPRINCE consortium aims **to set up the first worldwide open access foundry pilot line for heterogeneous integration by µTP** and to demonstrate its capability on five defined target application scenarios. For this purpose, the consortium members combine their expertise along the value chain from materials and equipment, technology and semiconductor processing, integrated circuit and system design, test and application. The partners are industrial companies, accompanied by leading research institutes with a clear focus on production and application in Europe. The working principle of the micro-transfer-printing technology is to use a microstructured elastomer stamp to transfer microscale functional components from their native substrates onto non-native substrates. The lateral dimensions of the functional components can range from a few microns to hundreds of microns. The native substrate contains the functional components to be printed and is flexible in size and material. The MICROPRINCE pilot line is acting as a **regional and nationwide competence cluster for a novel technology with European dimensions for heterogeneous system integration** and supports the ECS industry to reach leadership in key applications.

Key Data:

Project number:	**737465**
Project website:	www.microprince.eu
Project start:	1st April, 2017
Project duration:	3 years
Total costs:	EUR 14.017.817,61
EC funding:	EUR 3.340.035,74

Consortium: 13 partners (4 countries)

Project Coordinator: **Dr.-Ing. Ronny Gerbach**
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ECSEL Joint Undertaking

This project has received funding from the ECSEL Joint Undertaking under grant agreement No 737465. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Germany, Belgium, Ireland.

Technical Approach

The **MICROPRINCE** project is planned to run for 36 months and is subdivided into 8 work packages (WP). Between the work packages there are significant dependencies and expected synergies, which are described in the following:

WP1 „Design and installation of the µTP pilot line" targets the design, manufacturing and installation of the µTP pilot line clarifying the general set-up and defining all technological requirements of the industrial applications. A general process set shall be established to enable the transfer of the process for the industrial applications and the key application smart production.

WP2 „Micro-transfer-printing for high sensitivity magnetic sensors" industrializes the transfer printing and post-processes for obtaining MLX CMOS ICs with transfer printed high sensitivity magnetic sensing elements.

WP3 „Micro-transfer-printing for optical sensors" aims at the heterogeneous integration of optical filters. The main objective is the process transfer and industrialization of the printing of filters on optical sensors in the MICROPRINCE environment.

WP4 „Micro-transfer-printing for silicon photonics" aims to establish a pilot line for micro-transfer print and post transfer print operations of III-V active devices onto silicon photonics wafers for the key application smartsociety. The main objective of this work package is the qualification of the pilot line for the manufacture of two receiver chips.

WP5 „Micro-transfer-printing of LED devices" develops a LED driver IC with printed RGB LEDs integrated in one package targeting the key applications smart mobility and smart society. The output is a smaller package which leads to cost advantages and more flexible use cases.

In **WP6 „Micro-transfer-printing for biomedical implant applications"** the technology is developed to micro-transfer print III-V LEDs and silicon photodetectors onto a silicon nitride photonic integrated circuit. The target of this WP is the development of an implantable glucose sensing system.

WP7 „Dissemination, communication, exploitation and standardization" is dedicated to the communication, dissemination, exploitation, and standardisation of the project. The main objectives refer to the targeted communication of project results, the dissemination and contribution to a European Research Union, as well as the exploitation of the scientific results. Dissemination activities target to establish a corporate project.

WP8 „Project- and innovation management" is responsible for the operational management and technical vitality of the MICROPRINCE project encompassing management components on contractual, financial, legal, technical, administrative and ethical levels. Another focus of WP8 is to respond to opportunities, through active innovation management. These activities help to maximize the benefit to participants, project stakeholders and the overall impact of the project.

Partners:

- X-FAB MEMS Foundry GmbH, Germany
  X-FAB Semiconductor Foundries AG, Germany
- Huawei Technologies Research & Development Belgium, Belgium
- X-Celeprint Limited, Ireland
- Melexis Technologies NV, Belgium
  Melexis Technologies SA, Switzerland
  Melexis NV, Belgium
  Melexis GmbH, Germany
- Optics Balzers Jena GmbH, Germany
- Fraunhofer Gesellschaft zur Förderung der angewandten Forschung E.V, Germany
- Interuniversitair Micro-Electronica Centrum, Belgium
- University College Cork – National University of Ireland, Cork, Ireland
- Technische Universität Dresden, Germany

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