PhotonFAB

Silicon Photonic IC Fabless Access Broker

Support Action
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Deliverable 1.6 – Service portfolio

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Work package 1: Access

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential	**x**

1 Introduction

This document reports on the progress made in the service portfolio of ePIXfab by PhotonFAB, since Deliverable D1.3

- Expansion of the process portfolio available in IMEC and LETI technologies
- Exploration of processes available from external fabs
- Agreement of design rules and standardized mask specifications with external service providers for post-processing, packaging and design.

2 Expansion of process portfolio in IMEC and LETI technologies

2.1 LETI technology

During Y3, starting with the LETI07MPW shuttle, the LETI standard silicon photonics technology has been expanded with heaters (previously in the FLEX technology). This is building on the Y2 work to deploy a more standardized process for passives circuit to ease the coordination , reduce access cost and shorten the delivery time. Moreover for flexible access, LETI introduced new modules and specific processes to increase access for active devices

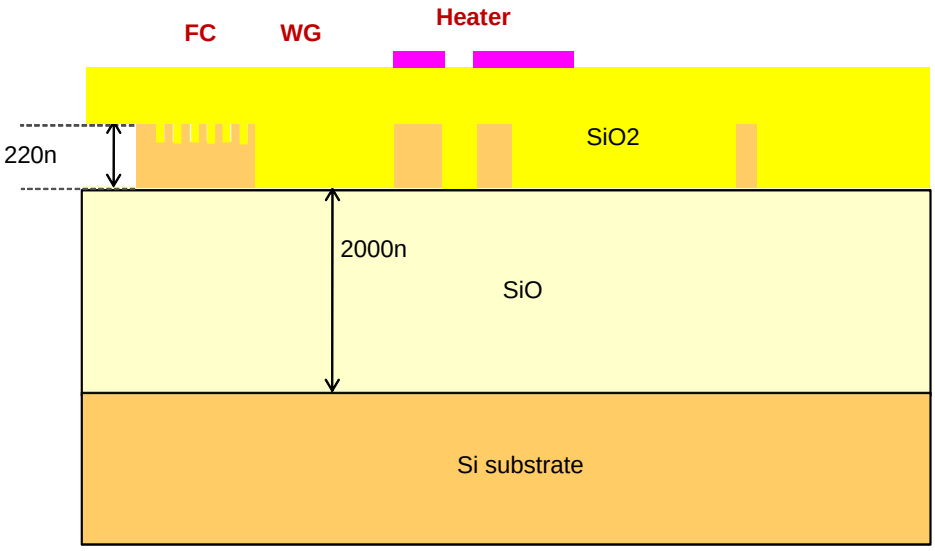

Figure 1: LETI heater technology

At the end of Y3, the LETI FLEX technology has been discontinued with in ePIXfab, due to the large support efforts needed to offer this process. The LETI06 shuttle was the last one for FLEX technology as delivery time should be end of the year Y3.

Users can still obtain access to it from CEA directly.

New standard masks

The mask design procedures and mask allocation schemes have been completely revised during Y3, by allocation of blocks of fixed size. This reduced cost and the effort needed for mask integration and for process definition requirements.

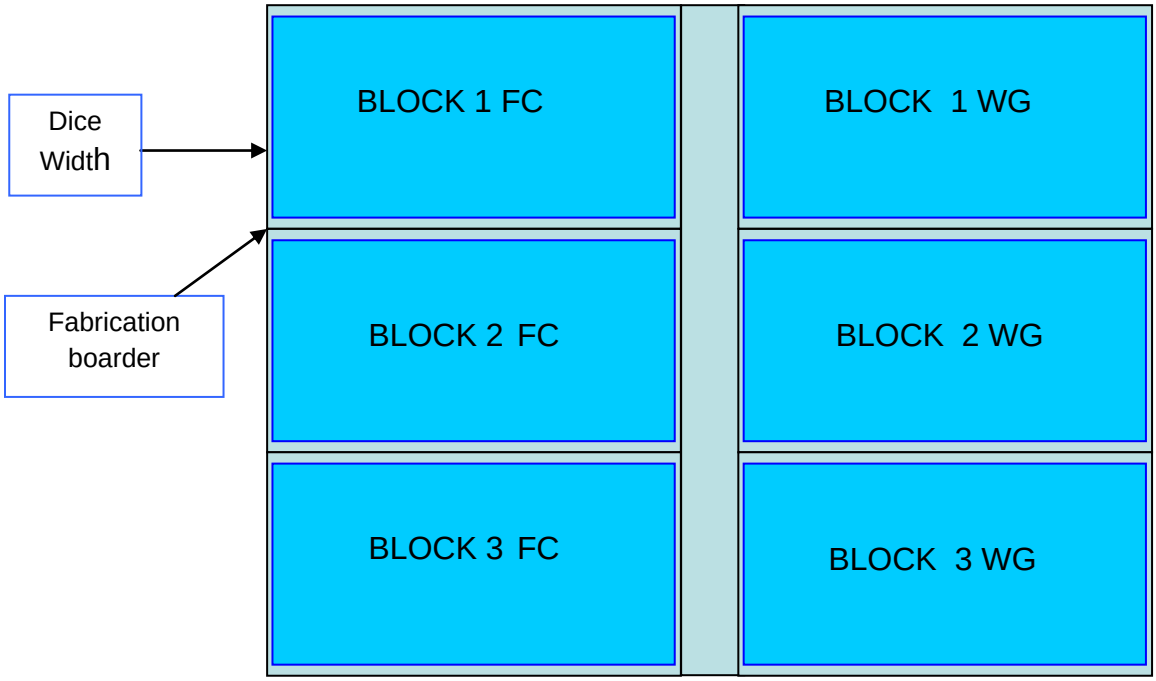

Figure 2: LETI block allocation

2.2 Imec technology

New process module: 'advanced passives'

During Y3, ePIXfab has offered for the first time the imec 'advanced passives' process. This process offers 4 etch depths in a single platform, yielding higher efficiency grating couplers and benefits for later integration of active devices.

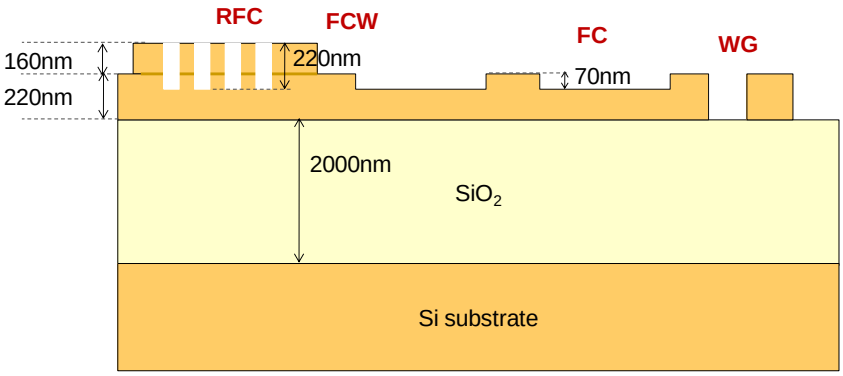

Figure 3: imec advanced passives

Edge couplers

A process for edge couplers on Imec chips has been deployed at Imec-Ghent University. This process works on a few samples rather than a full wafer. Due to customer demand in the past, we have decided to offer this small-scale process as a solution.

3 Exploration of processes available from external fabs

In the roadmap effort (WP3, Roadmap), a survey was made of the technologies available from external fabs. Considering submicron-type SOI technologies, a few are available:

- IHP (Germany, Frankfurt Am Oder) has developed during 2009-2010 a passive device technology on 220nm SOI, based on their 200mm line with 248nm DUV lithography.
- IME (Singapore) has a passive and active device technology available on 200mm wafers with 248nm DUV lithography. IME looks to expand into 193nm DUV lithography on 300mm wafers.
- A number of fabs have processes fully integrated with high-end microelectronics: Freescale, BAE, Texas Instruments, IBM. However these are currently not (yet) available to small users.

In addition, we have contacted several fabs on their potential interest to explore silicon photonics.

PhotonFAB organizes a meeting with other MPW service providers in silicon photonics to discuss common challenges, during the group IV conference, 16 September 2011.

- Will be present: opSIS, IME, ePIXfab (IMEC, LETI), IHP, Europractice
- Agenda:
    - Introduction
    - Brief roadmaps of the service providers opSIS, IME and ePIXfab
    - Offering small-use technology to world-wide users: opportunities for collaboration?

- Opportunities for a joint benchmarking effort

3.1 IHP

With IHP GmbH, a collaboration was started to practically test their waveguide technology. IHP developed technology partially within the framework of FP7 Helios. The waveguide dimensions are very similar to the imec and LETI standard passive technologies, even though the fab technology is different. The objective for IHP is to integrate a photonics module into one of their high-speed SiGe BiCMOS processes. Such process is being used for a demonstrator within Helios but is not ready for MPW access.

Imec design a test chip (July 2010) which was loaded onto an internal fabrication run at IHP, based on design rules provided by IHP. This chip is delivered and is undergoing testing at Imec.

This test serves two objectives: assessment of the current technology by an outside designer (imec), and first exploration of design rules needed to support external fabless customers.

The further development of the photonics module will take considerable time and public access to it cannot be foreseen for the very near future. However, we will work with IHP towards this on a 2-3 year timescale.

3.2 opSIS

opSIS is the U.S. MPW initiative similar to ePIXfab, based at Univerity of Washington. opSIS plans to offer BAE (US), IME (Singapore) and Luxtera/Freescale (US) technologies in MPW. The first public run of opSIS is in IME technology and very similar to what ePIXfab plans to offer in 2012: passive devices, fiber I/O, modulators and detectors.
Imec plans to design a test chip to benchmark IME's technology against our own technology. The consortium has also discussed whether to consider offering of the IME technology to the European public (through collaboration with opSIS).

4 Technical agreements with external service providers

ePIXfab maintains links with a number of external service providers for post-processing, packaging and test. As **no solutions have been available during 2009-2010**, it has also been impossible to setup the technical agreements on mask standardization. However, we have made significant efforts to push the further development.

Packaging and integration: IZM

Access to packaging and integration solutions from IZM has been clarified with a IZM webpage: http://www.izm.fraunhofer.de/EN/abteilungen/siit/technology/photonic/spic.jsp, and made accessible from the ePIXfab website.

Detailed design rules for 'gPack', concerning chip size, position of fiber I/O couplers, assist features, etc are under discussion between Imec and IZM.

Post-processing: AMO

AMO's e-beam technology may be well suitable for a number of customers to pattern structures that cannot be patterned with the current technology nodes offered by ePIXfab. AMO has built a webpage covering their technology offer, interlinked to the ePIXfab website.

Interoperatbility rules are under discussion. AMO will be able to handle 200mm wafers soon, but currently needs to work on ePIXfab samples.

ESSenTIAL project

In order to dedicate resources to further integration of packaging and integration services within ePIXfab, funding has been acquired from the EU in a new project (FP7 ESSenTIAL). There, two paths will be followed:

- A number of 'cheap' (few 1000€) cost-sharing fiber pigtailing solutions will be deployed
- New partners VTT and Tyndall will, together with CEA, offer their packaging and integration technologies, in a semi-standardized way, allowing for cost-sharing. In particular some of the technologies that have been identified in the meeting 10 November 2010:
    - A planar type of packaging to vertical grating couplers that is being developed by Tyndall
    - The VTT technology with 'thick SOI photonics' where both 'thin SOI photonics' and III-V dies can be integrated in a hybrid way.

Testing

Chip/device testing by ePIXfab customers

For network systems and subsystems, two actors are available in the European landscape that both work as a distributed lab that provides services to external customers (or have the intention to do so):

- PerSYST (www.persyst.fr), a platform in the CNRS Foton laboratory supports international researchers with their high-speed testbeds. No activity between ePIXfab and PerSYST has happened within PhotonFAB.

- EuroFOS (www.euro-fos.eu) is a FP7 Network on Excellence that has built a large scale set of system labs with high-speed network testbeds. ePIXfab will look with EuroFOS into the roadmap for using EuroFOS services by ePIXfab customers in the future.

The major bottleneck for using such service is that first generic package approaches for testbeds need to be available. This was indicated at several occasions, including on the concertation meeting on photonic networks, 20 October 2010 in Brussels.