Joint Lab

Technische Hochschule Wildau
Technical University of Applied Sciences

» Forschung in Wildau – innovativ und praxisnah «

Project BioPIC

Biosensors based on Photonic Integrated Circuits

Introduction

- Silicon-based photonic biosensors integrated into a semiconductor chip technology can lead to major advances in point-of-care applications, food diagnostics, and environmental monitoring through the rapid and precise analysis of various substances. In recent years, there has been an increasing interest in sensors based on photonic integrated circuits (PIC) because they give rise to cost effective, scalable and reliable on-chip biosensors for a broad market.
- Once the photonic chip is fabricated, the silicon surface of the sensor can be coated with a covalently attached sensing layer. This layer determines the specific detection and, hence, the application. This step, however, is independent from the fabrication of the chip, making the PIC and EPIC technology attractive for both, science and industry.
- The bottle-neck for a transfer from laboratory to industry is the position of the sensing area, since it adjoins optical and electronical components. This prohibits a full packaging and makes the sensor handling impractical.
- To tackle this general problem, the project BioPIC develops a novel integration approach to separate the sensing area from the rest of the chip. The project idea is to shift the sensor from the crowded and water-sensitive front-side of the chip to the back-side.

Device fabrication and prelimenary results

- The SiGe BiCMOS technology at IHP is an attractive technology for PICs from commercial point of view since it provides a scalable platform for mass production and the opportunity for monolithic integration of electronic and photonic devices, which is known as electronic photonic integrated circuits (EPIC).
- This allows the integration of sensors, detectors and read-out electronics in a single chip.

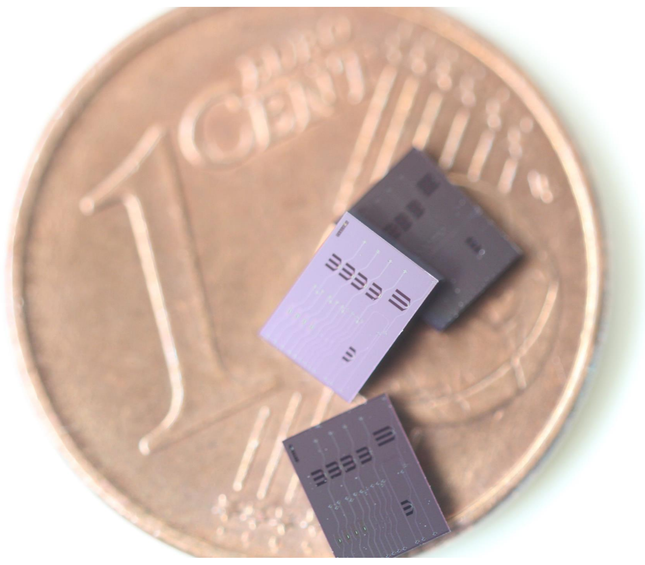

Figure 1: *CMOS-Chips with photonic integrated circuits comprising optical sensors for the specific detection of troponin. Fabricated at IHP in a SiGe BiCMOS technology.*

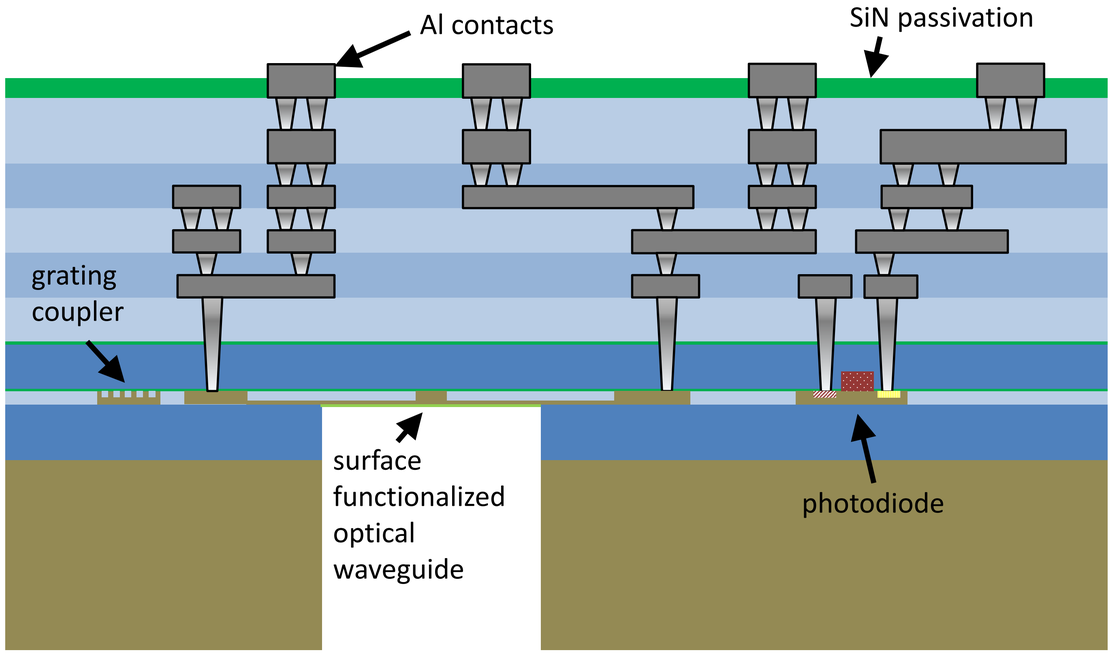

Figure 2: *Cross-section of a CMOS-chip showing the integration approach of the project BioPIC. In this case, the optical waveguide is released from the bottom of the chip.*

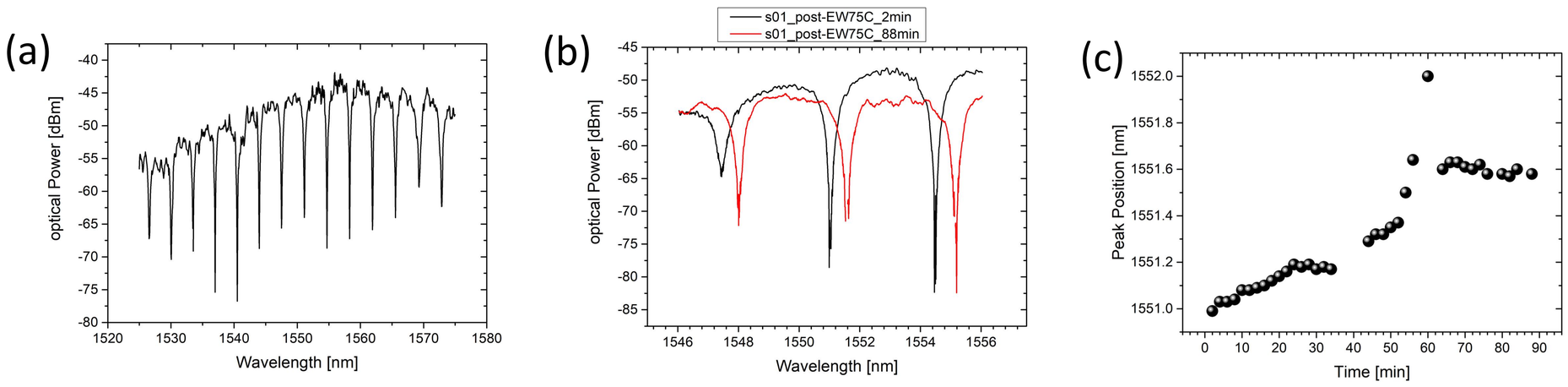

Figure 3: *(a) Spectrum after surface functionalization with EW75C. (b) High resolution spectra of the time dependent peak shift: 2 min and 88 min after start. (c) Peak position as function of time.*

Acknowledgement

ATTRACT

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Homepage:
https://www.th-wildau.de/forschung-transfer/joint-lab-ihp-th-wildau/

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