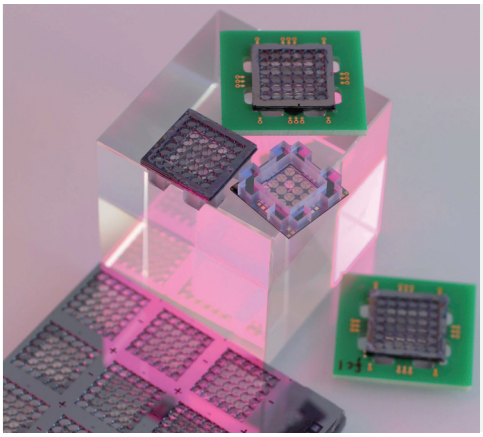
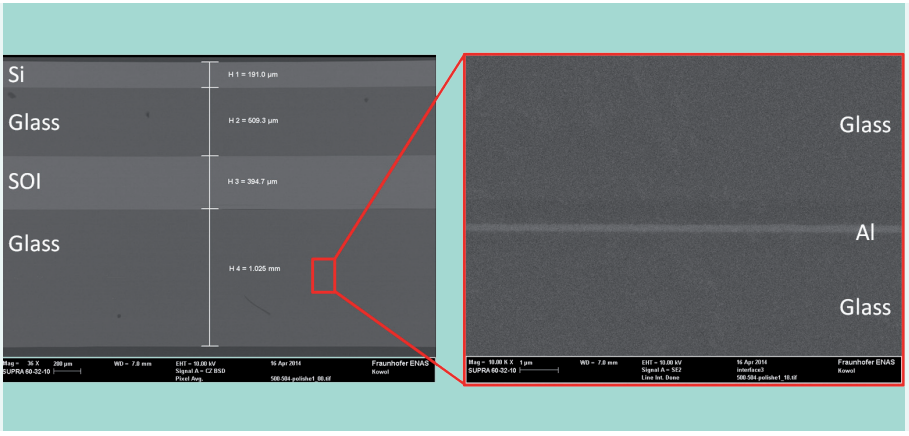
VERTICALLY INTEGRATED ARRAY-TYPE MIRAU-BASED OCT SYSTEM





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Figures:
left: Bonded and assembled Mirau interferometers.
right: Cross-sectional SEM image of a 5 bonding stack simulating a Mirau interferometer.

Photo acknowledgments: Fraunhofer ENAS

The EU project VIAMOS aims to develop a handheld, low-cost and multifunctional OCT (Optical Coherence Tomography) microsystem, which enables a painless and earlier detection of skin pathologies like melanoma and nonmelanoma cancers.

By combining swept-source OCT detection and micro-opto-electromechanical systems (MOEMS) technologies, a miniature, low-cost, portable OCT microsystem, which is 10 times cheaper and 150 times smaller than the conventional commercially available systems, is proposed. The OCT microsystem consists of a tunable light source, objective lens, an array of Mirau interferometers, a beamsplitter cube to superimpose the illumination with the imaging path and an imaging lens for the CCD camera. The incident light beam from a broadband light source is filtered by a tunable Fabry-Pérot interferometer (FPI), collimated and imaged on the skin. The backscattered light from the skin and the light from the reference mirror are imaged into a high-speed camera and form the measurement signal.

The SEM image shows a 5-stack demonstrator simulating a Mirau interferometer stack. A 200 µm silicon bonded with a 500 µm glass represents a micro lens wafer. The SOI wafer represents an actuated micro mirror. The bottom glass stack consists of 2 glass wafers, representing a spacer and a beam splitter. The higher magnification image shows that an upper glass is bonded with a bottom glass, where aluminum thin layer is deposited. The photograph image indicates the assembled Mirau interferometers. All bonding processes are carried out by anodic bonding and bonding temperature lower than 360 °C. The approach, which adopts vertically-stacked wafers along with electrical connection functionality, provides a space-effective integration of MOEMS device such that the Mirau stack can be further integrated with other components of the OCT microsystem easily.

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