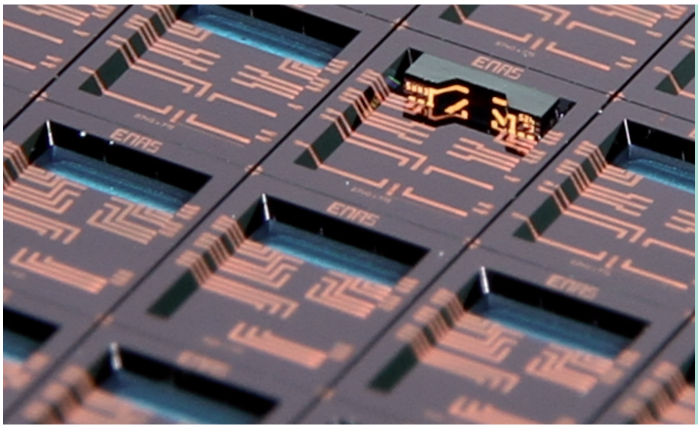
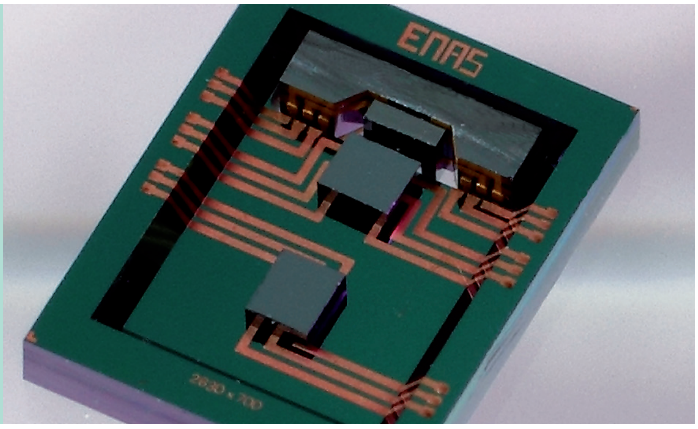
INTERPOSER TECHNOLOGIES AND FLEXIBLE SUBSTRATES





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For smart systems integration and More-than-Moore technologies the implementation of several components is necessary for reaching a higher functionality and smaller system dimensions. Therefore special substrates, e. g. flexible ones or even interposer made from silicon, glass and ceramics could be used for mounting and connecting sensors, actuators and electronics as chips or chip-sized-packages.

Silicon Interposer Technologies for 3D Sensor Systems

Within 3D integration for smart systems silicon and glass interposer are of increasing importance. One main reason is the possibility to adapt different design and technology rules from microelectronics and MEMS processes. With interposers a redistribution of interconnects could be realized and at least a chip-sized package with different components is enabled.

Fraunhofer ENAS developed a special customized interposer technology for mounting the sensor chips in X, Y, and Z direction consisting of two interposer components. Both the 3D interposer and the carrier device are fabricated on 6 inch silicon wafer substrates by using common semiconductor technologies. In respect to the small size of the silicon devices an efficient production on 150 mm substrates is possible due to the parallel processing on wafer level. PVD and ECD are used to metalize the interposer and carrier device. The carrier device is inserted into a dry etched through silicon hole. ECD grown copper pads connect the carrier device to the 3D interposer. The electrical connection between both devices is done by soldering at least.

The advanced connection principle is developed for narrow alignment. The interposer technology can be used for a variety of MEMS devices, which have to be placed, molded, and aligned to a substrate (3D integration). Using these technologies also other sensor systems could be mounted for 3D measurement.

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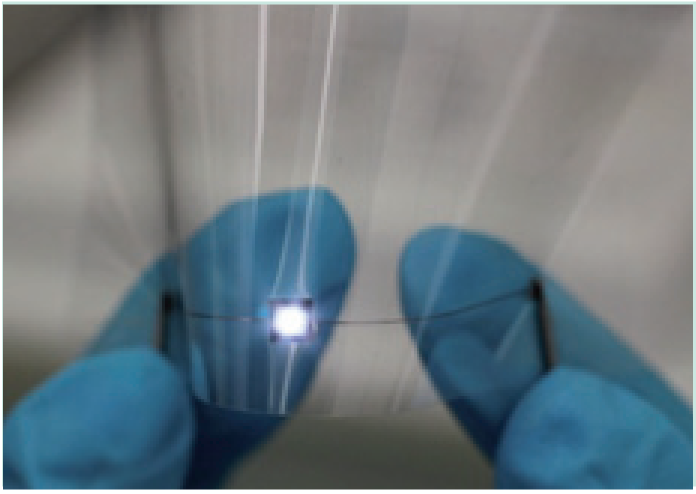

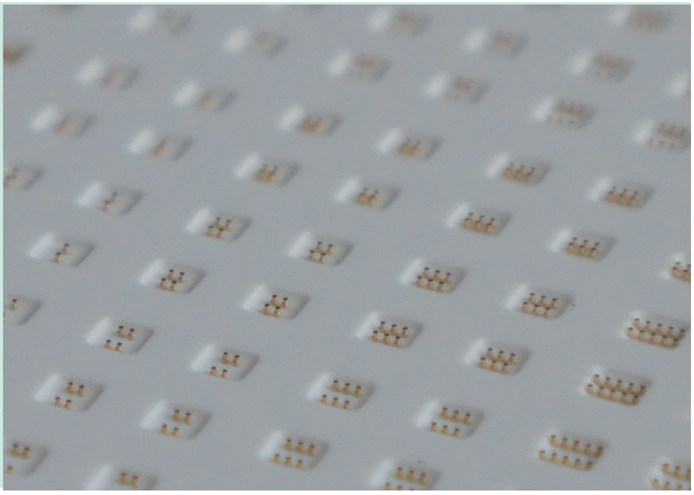

Thin Film Packaging

Another example is the integration of inertial and temperature sensors, electronics and RF components on a flexible substrate. An active radio frequency identification (RFID) label for the monitoring and recording of shock, inclination and temperature during transportation processes has been developed. The specific challenges are the limited energy supply, the very thin and flexible complete system and the high dynamic range of the sensor at low manufacturing costs.

The Active Smart ID Label includes the RF chip with antenna, the battery for the energy supply as well as the sensor system, consisting of the micromechanical transducer and the signal processing.

Printing Technologies

A close relation exists to printing technologies because flexible substrates are focused there. The department Printed functionalities is working on printed antennas, printed batteries and printing of conductive interconnects. A special focus is the development of printing technologies for Role-2-Role fabrication.

Another printing technology is Aerosol-Jet printing, where a printing on topographic surfaces with very fine structures is possible. A research topic here is the interconnect printing from chip surfaces down to the substrate.

Figures:
page1: Si Interposer solution to enable 3D sensing of the earth's magnetic field with lowest height af 1 mm. Chip-to-wafer integration: interposer at wafer-level with integrated carrier. (left); Demonstration sample of a 3D interposer with sensor chips. (right).
page 2: LED on flexible substrate. Aerosol-Jet printed conductive lines. (left); Ceramic wafer with porous gold pads. (right)

Photo acknowledgements: Fraunhofer ENAS

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