SUCCESS STORY

ASSIC
Austrian Smart Systems Integration Research Center

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: K1 COMET-Centre

Type of project: Smart Semiconductor Process Development, 01/2015 – 12/2018, multi-firm

TFAP™ CHARACTERIZATION AT HIGH PRESSURES AND HIGH TEMPERATURES

PRECISE CHARACTERISATION OF OVERMOLD CONDITIONS FACILITATES ACCURATE TFAP™ MODELING AND ROBUST DESIGNS

White-light interferometry has become an established method in many industries, including the precision machining, Microelectromechanical Systems (MEMS) and Micro-Opto-Electro-Mechanical Systems (MOEMS), solar, medical, and biological fields. However, some of these devices perform differently once encased in their final packaging, which may include vacuum, elevated temperature and pressure, or special protective environments. In other words, some devices are required to be investigated in their final stage, which implies measurements through a protective liquid, plastic, or glass.

Since the common objective lenses of the interferometers are not designed for such mediums, due to the dispersion of the liquid, plastic, or glass, the white-light fringes may be totally washed out. For this reason, compensation objectives need to be inserted into the reference arm of interferometer.

The competence centre ASSIC's research team consists of Dr. Ali Roshanghias, DI Alfred Binder, Dr. Jozef Pulko and Dr. Jochen Bardong developed a novel instrumentation configuration, which facilitates in-situ analysis of thin-film acoustic packages (TFAP) under controlled temperature and pressures. In this Project interferometric optical microscopy was proposed as not only a means for topographical measurements at ambient condition, but also a robust and versatile tool for characterizing the behaviour of microstructures under defined

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temperature and pressure conditions. An optional through-transmissive-media interferometric Michelson-type objective, which consists of an optical compensator to enable measurements through transmissive-media, was employed. Conclusively, a novel instrumentation configuration, which facilitates in-situ analysis of samples of interest under controlled temperature and pressures, was developed.

A pressure chamber was designed and fabricated in the course of this project. The chamber comprises an optical access for the microscopic observation, where glass slides in different thicknesses can be inserted. The chamber contains a volume of about 1 cm^3 for positioning the samples. A resistive heating rod, driven by a feedback controlled power supply, was incorporated to adjust chamber temperature from ambient temperature up to 200 °C. As an example, the deflection of a typical TFAP samples induced by hydrostatic pressure at different pressures up to 100 bar is presented in Fig. 1.

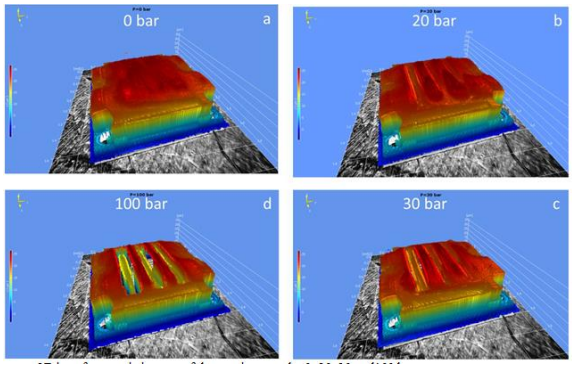

Fig. 1: 3D interferometric images of the TFAP specimen under 0, 20, 30 and100 bar pressure (© CTR)

Impact and effects

The aim of this project was to design and tailor a 3D interferometer featuring a pressure chamber as a means for measuring the surface topography of MEMS packages. It is estimated that approximately 50 to 80 percent of the total cost of MEMS production comes from final packaging and test; therefore, this technique can be an asset in mimicking and predicting the mechanical behavior and hermetic sealing properties of MEMS packages, i. e. TFAP.

Project coordination
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Project partner

- RF360 Europe GmbH, Germany (TFAP is a trademark of Qualcomm Incorporated)

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