MS37 Advances in Structure determination of new materials by multi-technique approach including imaging techniques

MS37-03

HRXRD and micro-CT Investigation of Stress and Defects Induced by a Novel Packaging Design for MEMS Sensors

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Abstract

Advanced methods such as high-resolution X-ray diffraction and X-ray micro CT allow highly precise determination of residual stress, volume, and lattice defects in functional materials. Their conjoint exploitation allows a multiscale approach to investigating the materials' microstructure [1] and offers a powering tool to facilitate the industrial implementation of novelties in microfabrication. The wafer-level packaging is a critical step of the MEMS microfabrication resulting in an airtight interface, stress-free and devoid of defects [2-4]. In this work, such critical parameters are investigated for the first time related to a novel wafer-bonding process, namely Impulse Current Bonding (ICB) [5-6]. Moreover, they are compared to the same characteristics associated with the standard anodic bonding technology used for MEMS production [7-9]. The microstructural investigations by HRXRD prove that the ICB does not induce any relevant residual stress at the interface above the limit of 1 MPa, determined by the unrivaled strain detectability of HRXRD. The bonding interface is devoid of any defects, as defined by X-ray micro-CT studies.

The ICB technology is promising related to the reduction of the energy footprint of the microelectronic industry in virtue of the outstanding reduction of the thermal budget of the packaging up to 85% compared to the anodic bonding. Moreover, the extension of ICB to other materials systems such as glass to ceramic or metals makes this technology a promising candidate for numerous applications, including the design of biocompatible devices for bio-implants.

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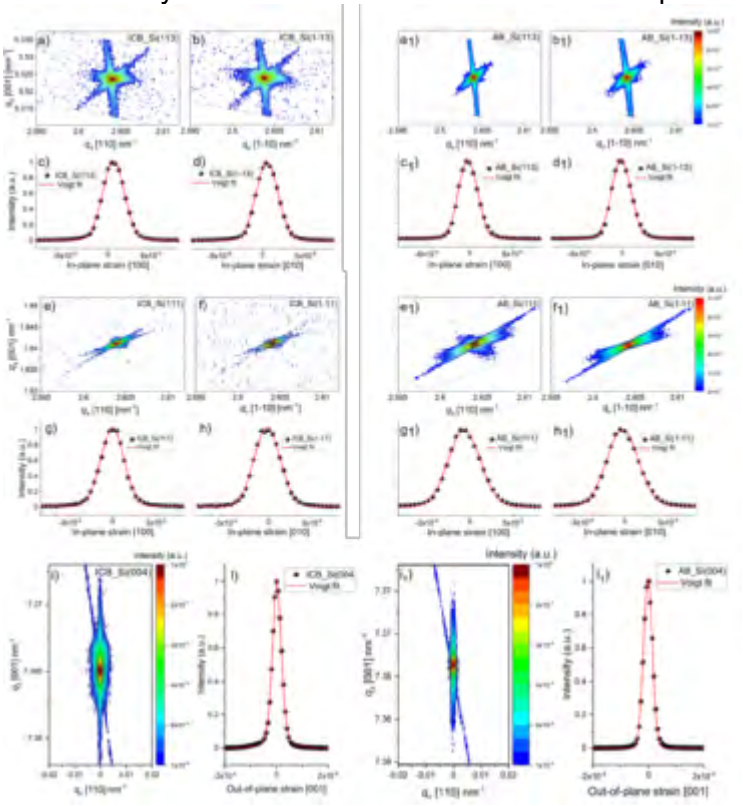
HRXRD analyses on the ICB and AB assembled samples



X-ray micro-CT and SEM analyses on one sample asse