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Synchrotron radiation based imaging methods for industrial applications at the German light source ANKA

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ANKA is a synchrotron facility at the Forschungszentrum Karlsruhe (Karlsruhe Research Center), operated by the Institute for Synchrotron Radiation (ISS) with user operation since 2003. ANKA is part of the national and European infrastructure offered to scientific and commercial users. Commercial users have full access to the ANKA facility on a contractual basis via ANKA's commercial services.
An imaging group within the ISS works on the development of instrumentation and methods as well as the application of imaging methods within inhouse research or projects with scientific and commercial users. Part of the activities of the group is also the management plus scientific participation in an European project for the development of novel X-rays detectors based on thin scintillating crystals. These novel detectors will be characterized and used at ANKA for topography and microtomography.
The white beam synchrotron topography as performed is based on recording a Laue-pattern of reflections where each reflection contains a topograph from the same investigated crystal position. The method is of high interest for the semiconductor industry as topographs deliver non-destructively information about e.g. dislocations and dopant inhomogeneities within a single-crystal. Mapping for example a selected topograph of a 300 mm Si-wafer allows to detect local defects which can lead to failures and losses in the production of semiconductor devices.
High resolution and phase contrast radiography is used to investigate micro-structured, multi-component material systems, e.g. to detect delaminations between substrates and glob tops encapsulating wire-bonded devices. Radiographs taken from different projection angles for computed micro-tomography allow to image objects in three dimensions with a spatial resolution down to the sub-micrometer range, e.g. bio-ceramics in regenerating bone. The application of 3D image analysis methods derived from stochastic geometry can be used for the determination of size distributions, orientations or spatial correlations within the tomographic, multi-constituent volume images.

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