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Synchrotron studies for optimization of Selective Laser Melting manufacturing of alumina parts

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Applying the Selective Laser Melting (SLM) technology to ceramics is challenging due to not understood mechanisms of interaction of the powder with laser light, high melting temperature and low thermal shock resistance. FUORCLAM (Fundamental Understanding of Oxide Refractory Ceramics and Laser Additive Manufacturing) is a project in collaboration between PSI, ETH and EMPA, which aims to establish SLM manufacturing technology of alumina. The approach used in this project is to utilize small amounts of metal oxide additives in in alumina granules to enable the efficient absorption of laser light.
In order to optimize the process, studies of micro- and macrostructure of the ingredient powder and the printed parts are essential. This is achieved by employing advanced synchrotron techniques. The powder used for SLM is composed of spray-dried alumina granules. The composition and crystallographic structure of the granules and printed parts is studied by means of combined micro-XRD/micro-XRF 2D and 3D imaging (microXAS) and high-resolution powder diffraction (MS beamlineI). These studies demonstrated a uniform dopant distribution in as-produced alumina granules and capability to modify it prior to laser treatment. Quantitative analysis of porosity and cracks is performed by synchrotron tomography (TOMCAT).

Position

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