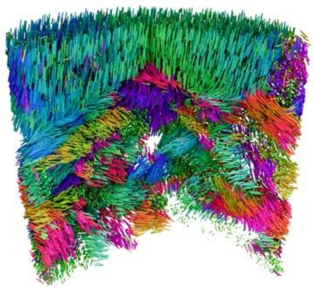
PSI Facility Newsletter

https://www.psi.ch/science/facility-newsletter

SLS – Mapping the Nanoscale Architecture of Functional Materials



At the SLS, researchers have developed a pioneering X-ray technique, X-ray linear dichroic orientation tomography (XL-DOT) to probe the 3D orientation of a material's building blocks at the nanoscale. Applied here to a polycrystalline catalyst, the technique allows the visualisation of crystal grains, grain boundaries and defects – key factors dictating catalytic performance. Beyond catalysis, the innovation unlocks previously inaccessible details about the structure of diverse functional materials, including those used in information technology, energy storage and biomedical applications.

Local ordering is inextricably linked to many of its material properties, according to the size (which can be on the scale of a few nanometers), orientation, and distribution of crystalline grains and their interactions. This work intimately depended on the provision of coherent x-rays, a feature that will be of the order of 1000 times greater after the SLS upgrade.

Read more *https://www.psi.ch/en/news/science-features/mapping-the-nanoscale-architecture-of-functional-materials, A. Apseros et al., Nature*

SLS – Mitigating Cracks in Multi-Material Printing

Laser powder bed fusion is a versatile additive manufacturing technology capable of producing multi-material metallic structures. However, when using two different metallic powders, significant challenges arise, including powder contamination, limited powder reusability, and the formation of interfacial defects like brittle intermetallic compounds (IMCs); these issues can compromise the mechanical integrity and functionality. An operando diffraction study at the Materials Science beamline demonstrated the advantages of combining metallic powders with thin foils, rather than relying solely on powders. Traditional powder-based approaches often lead to delamination and cracks at the interface due to the formation of brittle IMCs like Al_3 Ti. By introducing a Ti-foil, significant improvements were observed, notably, a thinner IMC layer, a reduction in residual stresses, and a crack-free interface.

Read more: *https://www.psi.ch/en/smam/scientific-highlights/mitigating-cracks-in-multi-material-printing. Original article: A. M. Jamili et al., Additive Manufacturing*
