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Advanced characterization of additive manufacturing samples through Bragg edge imaging

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Additive manufacturing (AM) has gained significant importance in the past years and is regarded to have the potential to revolutionize the manufacturing processes of materials, enabling complex geometries that are not feasible to be built using conventional manufacturing processes. The increasing complexity of AM-built components demands advanced spatially-resolved characterization techniques to characterize the microstructure distribution with the corresponding three-dimensional spatial resolution. Bragg edge imaging (BEI) holds great potential in spatially resolved studies of engineering materials, and enables local crystallographic observations even in complex components. The technique is based on the wavelength-dependent effect of neutron diffraction at crystal lattice planes on the neutron transmission spectrum. The wavelengths of discontinuities (Bragg edges) in the neutron transmission spectrum, directly relate to respective lattice spacings, allowing crystalline phase identification and lattice strain analysis, while the overall wavelength-dependent transmission pattern provides information of other microstructural features as defects or texture variations. Here, different examples will be presented, related to the application of BEI for advanced microstructural characterization of additive manufacturing samples, layered specimens built by multimaterial laser powder bed fusion and complex metastable steel components built by LPBF with locally tuned microstructure.

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