X-ray Diffraction Imaging Techniques for Non-Destructive Characterization of Crystalline Grains Inside Bulk Polycrystalline Alloys

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The mechanical and physical properties of polycrystalline alloys are governed by a combination of the properties of the crystalline grains inside. Hence, the non-destructive characterization and quantitative analysis methods for investigating crystalline grains are of great importance to understand the overall properties of alloys. Unfortunately, most conventional characterization techniques are two-dimensional in nature and require the sample to be physically sliced. We report two kinds of X-ray diffraction imaging techniques that can meet this challenge, that is, Three-dimensional X-ray diffraction (3DXRD) microscopy and Bragg Coherence Diffraction Imaging (Bragg-CDI). In the mesoscopic scale, 3DXRD technique can provide information on many parts of the individual structures simultaneously, including spatial distribution, size, morphology, phase, crystalline orientation and elastic and plastic strain. Three applications on phase identification, grain quantitative analysis and ex-situ strain analysis will be presented. In the nanoscale, Bragg-CDI technique provides an opportunity for stress and strain study on nanocrystals. After the construction of High Energy Photon Source (HEPS) in Beijing, our nanoprobe beamline will provide the focusing beam down to 30 nm with the coherent flux of 5×10^9 phs/s/0.1%B.W.

Biography

Dr. Yiming YANG is a physicist and received his doctoral degree from the CAS (China) for a work on X-ray diffraction microtomography and its three-dimensional quantification of crystalline grains in alloys in 2017. After graduation, he joined the Institute of High Energy Physics, CAS and has been participating the design and construction of nanoprobe beamline of the HEPS project.