

High-throughput microstructure characterization

Keywords: 2D/3D microstructure characterization; quantitative electron microscopy

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Design and Producing Field / Corrosion Resistant Alloy Group

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Background

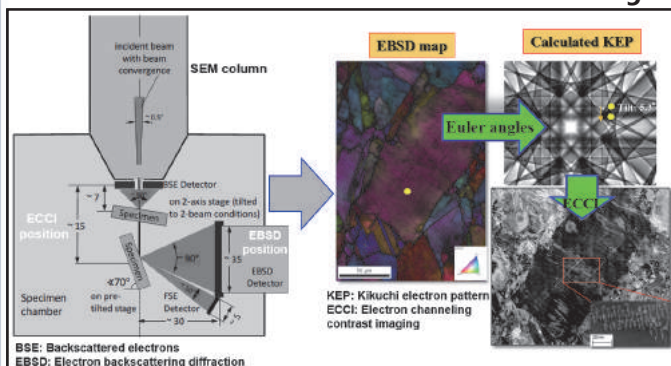
- Alloy design of next-generation structural materials requires the development of efficient quantitative microstructure characterization techniques.
- 2D/3D SEM methods provide unveiled microstructure insights of engineering materials at a large field of view that allow faster design performance.

Aim

- The aim is to develop novel 2D/3D Scanning Electron Microscopy methods based upon in situ SEM approaches, electron backscattered diffraction (EBSD) and electron channeling contrast techniques that allows high-through output microstructure characterization of structural materials.

Advanced Research Topics

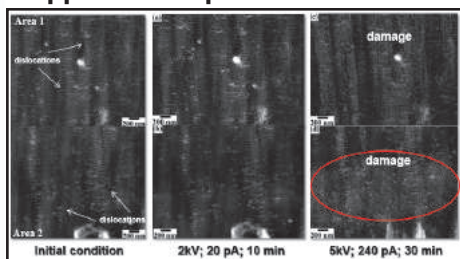
SEM-Electron Channeling Contrast Imaging



- Imaging of crystal defects in bulk metals by conventional SEMs
- Optimum electron channeling contrast of crystal defect is attained by calculated Kikuchi Electron Patterns retrieved from EBSD mapping
- Quantitative characterization of deformation structures of metallic materials from macro-to nano scale

構造材料

Application: Optimization of ion milling settings for crystal defect-free sample preparation



| | surf. disl | deep disl. | Ga+ depth |
|-----------------|------------|------------|-----------|
| 2kV-20 pA-10' | ✓ | ✓ | 5 nm |
| 5kV-240 pA-30' | ✓ | ✓ | 8 nm |
| 30kV-240 pA-10' | ✗ | ✗ | 23 nm |

Material: 316L stainless steel

Publications

- I. Gutierrez-Urrutia, S. Zaefferer and D. Raabe, Scripta Materialia 61 (2009) 737
- I. Gutierrez-Urrutia et al, STAM 17 (2016) 220
- I. Gutierrez-Urrutia, Journal of Microscopy 265 (2017) 51

Applied area and future prospects

- Quantitative microstructure characterization of deformation structures of bulk metallic materials
- Optimum sample preparation by ion milling-based techniques
- Future prospects: upgraded EBSD based ECCI set-up, 3D SEM-ECCI

Issues for technology transfer

- SEM manufacturers: Design of high-performance BSE detectors, EBSD-based ECCI set-ups and sample stages
- Manufacturers of devices for TEM/SEM sample preparation
- Characterization Labs of metal manufacturers