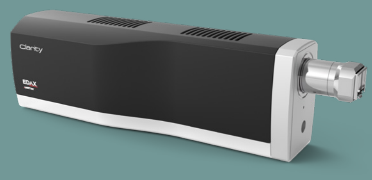
Clarity EBSD Analysis System

Product Bulletin – EBSD



- Direct electron detection of EBSD patterns
- Zero distortion for ultimate sharpness and maximum details
- No read noise for high sensitivity
- Single-electron detection
- True quantitative intensity measurements
- Ideal for beam-sensitive materials and HR-EBSD

Clarity™ – The world's first commercial direct detection system to produce high fidelity Electron Backscatter Diffraction (EBSD) patterns. This revolutionary system eliminates detector noise and distortions, opening new doors to unparalleled EBSD pattern quality and sensitivity.

Current phosphor-based EBSD systems have some drawbacks. Specifically, the phosphorescent material's grain size and the film thickness can decrease the electron-to-photon conversion efficiency and cause localized blooming of the signal. As a result, the optical coupling between the phosphor and the imaging sensor produces imaging artifacts in the EBSD patterns. For Hough-based indexing, such small imperfections may not be crucial but limit the fine details within an EBSD pattern for advanced quantitative analysis. Direct detection removes all these steps and corresponding issues from the EBSD collection chain.

Clarity does not require a phosphor screen or light transfer system. The technology uses a CMOS detector coupled to a silicon sensor. The incident electrons generate several electron-hole pairs within the silicon upon impact, and a bias voltage moves the charge toward the underlying CMOS detector, where it counts each event. This method is so sensitive that it can detect individual electrons.

Coupled with zero read noise, the Clarity provides unprecedented performance for EBSD pattern collection. It can successfully detect and analyze patterns comprised of less than 10 electrons per pixel. But even this value is slightly misleading, as the electron signal onto the EBSD detector is non-uniform. Only the pixels in the middle of the pattern have the highest electron intensity. Near the edge, pixels may only count a few electrons and still produce a usable EBSD pattern.

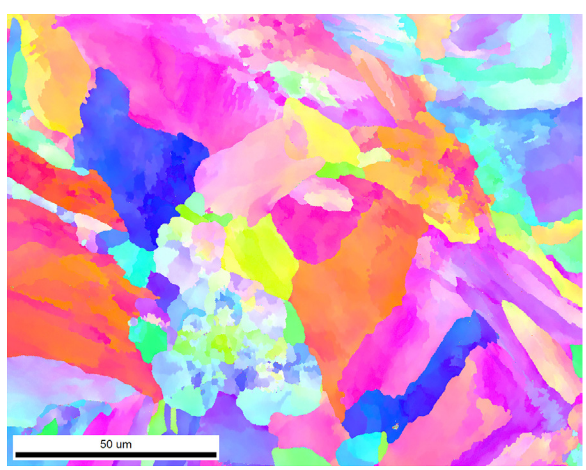


Figure 1. EBSD orientation map was collected with Clarity from an additively manufactured stainless steel sample showing deformation structure on average.

Specifications

- Hybrid pixel direct electron detector
- 512 x 512-pixel image resolution
- Zero read noise and distortion
- Operation down to <10 pA beam current
- EBSD mapping speeds up to 85 indexed points per second
- High dynamic range imaging
- Single-electron sensitivity
- Pixel binning for an increased signal during EBSD mapping
- Electron energy thresholding
- Compatible with OIM Analysis™
- Compatible with HR-EBSD
- Motorized slide with metal bellows vacuum protection
- PRIAS™ and Forward Scatter Detector included

Features and Benefits

Beam-Sensitive materials analysis

- Delivers single-electron sensitivity with zero read noise
- Analyzes materials like perovskite solar cells that do not produce useable EBSD patterns under typical beam currents
- Eliminates the need for conductive coatings or low-vacuum SEM settings to assess non-conductive materials like ceramics that charge under typical beam currents
- At low beam currents, obtains high-quality EBSD patterns and maps for investigating the effects of grain boundaries, grain size, and crystal orientation

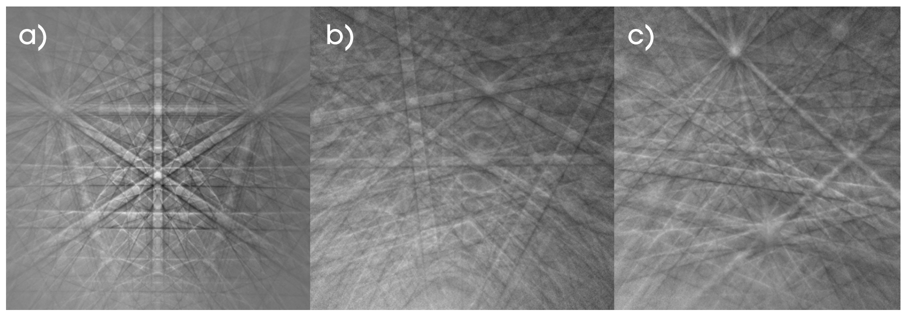


Figure 2. High-quality EBSD patterns collected with Clarity from a) silicon, b) olivine, and c) quartz.

Traditional Materials

- Uses high-dynamic-range imaging to ensure excellent EBSD pattern quality.
- Enables the collection of extremely sharp EBSD patterns without using phosphor or optical lenses.

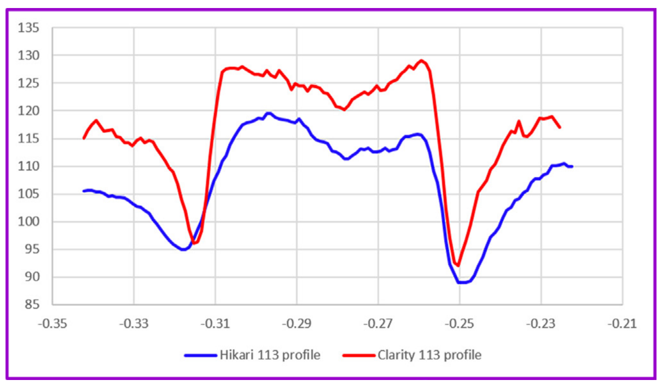


Figure 3. Intensity profile across (113) band from the Hikari Super and Clarity detectors showing improved contrast and sharpness with direct detection.

Conclusion

In summary, the Clarity EBSD Analysis System provides unparalleled sensitivity and pattern quality for EBSD pattern collection and mapping. It enables the analysis of beam sensitive materials and provides quantified information about electron intensities onto the detector.

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