BRUKER

OPTIMUS™

Detector Head for Transmission Kikuchi Diffraction in SEM

Innovation with Integrity

EBSD

Ideal Geometrical Conditions for TKD

The OPTIMUS™ TKD detector head was specially designed to provide the best sample-detector geometry for Transmission Kikuchi Diffraction in the scanning electron microscope. It is user-interchangeable with the standard EBSD detector head of all Bruker ***e⁻Flash*** detectors. OPTIMUS™ integrates the ARGUS™ direct electron detection system for microstructural images at highest possible resolution.

A unique solution for Transmission Kikuchi Diffraction in the scanning electron microscope

The unique OPTIMUS™ TKD detector head by Bruker features a horizontal phosphor screen which can be inserted underneath the electron transparent sample to acquire the diffracted electron signal where it is strongest and least distorted. In addition to acquiring Kikuchi patterns with unmatched sensitivity, OPTIMUS™ can also be used to record Selected Area Electron Diffraction (SAED) patterns very similar to those seen in a transmission electron microscope, practically transforming a SEM into a TEM but at a fraction of the cost and effort.

Ease of use and maximum compatibility

The OPTIMUS™ TKD detector head is compatible with all Bruker ***e⁻Flash*** EBSD detectors. A trained user requires less than 20 minutes for the exchange of detector heads, enabling easy switching between EBSD and TKD analysis setups, as required. The ESPRIT 2 analytical software suite provides features specifically for TKD, e.g. automatic pattern center calibration. Additionally, OPTIMUS™ works perfectly in combination with the Bruker TKD sample holder as well as all Bruker XFlash® EDS detectors.

OPTIMUS™ TKD detector head below a sample

Unique sample-detector geometry: OPTIMUS™ TKD detector head positioned underneath the Bruker TKD sample holder containing an electron transparent sample. The integrated ARGUS™ imaging system with its characteristic three Si diodes is visible at the front of the detector head.

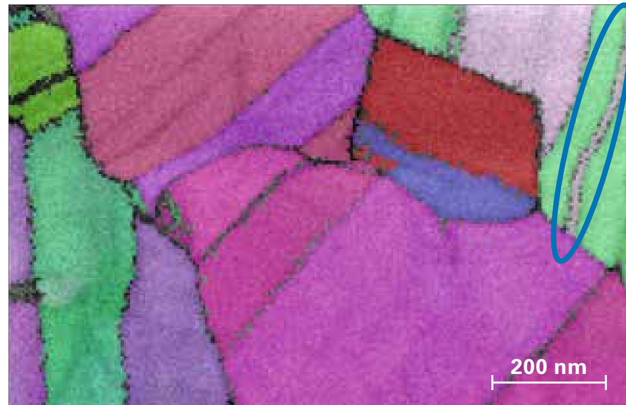
Orientation mapping with ultra-high spatial resolution

Placing the phosphor screen underneath the sample has two big advantages compared to the standard screen configuration, i.e. vertical screen:

- a much stronger signal
- the lowest possible gnomonic projection distortions

Thanks to the gain in signal provided by OPTIMUS™, users can either acquire data faster using a normal SEM probe current or obtain improved lateral spatial resolution by using lower probe currents. Alternatively, the SEM acceleration voltage can be reduced. This improves the analysis of very thin samples, as low energy electrons are more likely to be diffracted on the grain lattices. OPTIMUS™ allows the acquisition of Kikuchi patterns even at 5 kV. The possibility of centering the pattern on the screen minimizes pattern distortion, which leads to further improvement of both band detection and indexing accuracy.

Orientation map acquired with OPTIMUS™



Orientation map from a data set acquired with OPTIMUS™ from a silicon carbide thin sample prepared by FIB. The encircled area is only 16 nm wide and could still be correctly indexed as a twin.

Integrated ARGUS™ direct electron detection system

The integrated ARGUS™ direct electron detection imaging system provides brilliant color coded orientation contrast (dark field) images with extremely high spatial resolution. Apart from being sensitive to angular changes in the Kikuchi patterns of a minimum of 10^{-3} degrees the ARGUS™ dark field images can be used to visualize individual dislocations and networks of dislocation walls in deformed materials, or even 3D information on boundary plane inclination.

ARGUS™ high resolution images acquired in transmission

(a) (b)

a) Dark field image of a FIB-prepared SiC sample, characterized by a heavily twinned microstructure with some domains only 6–10 nm wide. The enlarged section shows a 3D effect caused by boundary plane inclination.
b) Pure aluminum sample heavily deformed by Equal Channel Angular Pressing (ECAP). Individual dislocations can be seen along cell boundaries (encircled region).

Specifications

- Unique horizontally positioned phosphor screen
- Works with electron energies down to 5 keV and probe currents down to 100 pA
- Integrated ARGUS™ imaging system for dark & bright field image acquisition
- Compatible with all existing ***e^-Flash*** EBSD detectors
- User-interchangeable within minutes
- Automatic collision protection system
- Integrated in ESPRIT 2 software via TKD mode
- Seamless integration with the Bruker TKD sample holder and all XFlash® EDS detectors

For further information scan the QR code or visit www.bruker.com/optimus-tkd

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