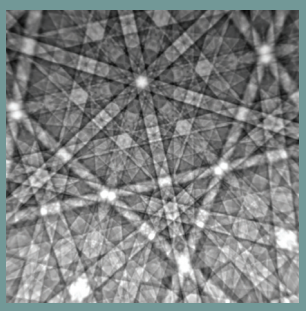
EDAX Smart Insight

AMETEK® MATERIALS ANALYSIS DIVISION

Product Bulletin - EBSD

OIM Matrix™



- Accurate simulations of EBSD patterns
- Incorporates dynamic diffraction effects
- Compare simulated and experimental EBSD patterns
- Dictionary Indexing functionality
- Integrated with OIM Analysis™
- Requires OIM Analysis™ v8 or greater license
- Automatic structure file optimization
- EBSD Background simulation
- Turnkey solution for simulations and Dictionary Indexing

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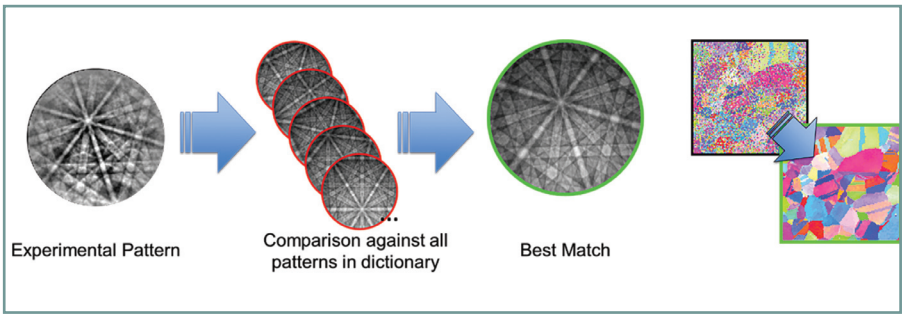
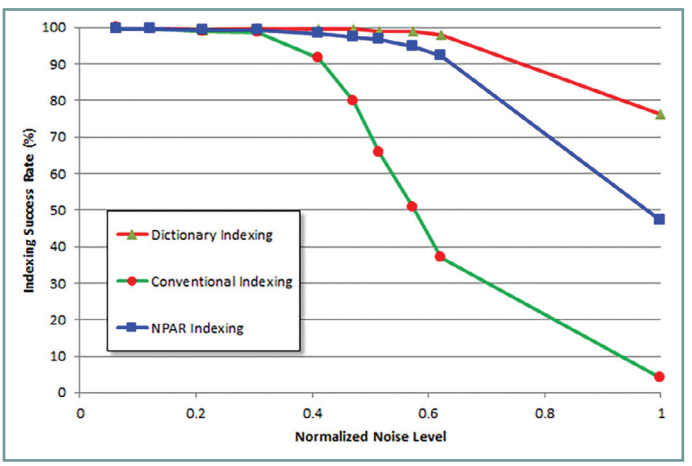
The OIM Matrix™ software package, which is offered as an optional module for OIM Analysis™, allows users to simulate EBSD patterns based on the physics of dynamical diffraction of electrons. This approach more accurately describes the behavior of the electron interactions within a sample and produces more realistic pattern simulations compared to traditional kinematic diffraction-based approaches. These simulated patterns can then be more easily and accurately compared with experimentally collected EBSD patterns.

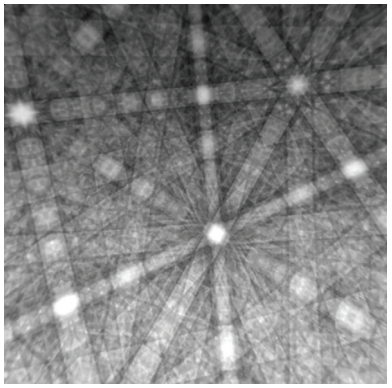


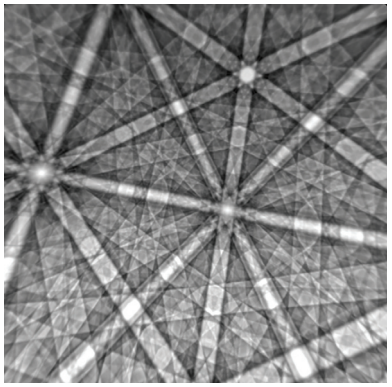
Schematic of the Dictionary Indexing processes using a library of simulated patterns.

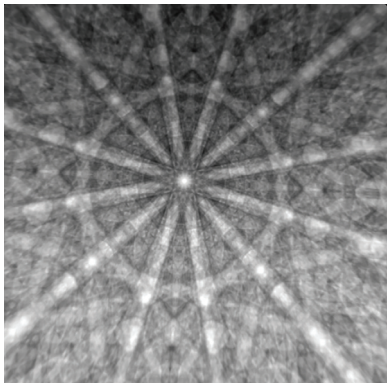
OIM Matrix™ can be used to create a library of EBSD patterns for all crystallographic orientations for a given material. Experimental patterns can then be compared and matched with the best fitting pattern in the library, in an approach termed Dictionary Indexing, developed for EBSD by the group of Prof. Marc De Graef at Carnegie Mellon University. Dictionary Indexing improves indexing success rates over standard Hough-based indexing approaches. Within OIM Analysis™, Dictionary Indexing can be combined with partitioning functionality and other indexing tools for efficient indexing improvements and better overall data quality.



Comparison of indexing rates of Dictionary Indexing with conventional and NPAR™ approaches with increasing EBSD pattern noise.







Dynamically simulated EBSD patterns for: $Cr_{23}C_6$ (top), TiN (middle), and Sigma (bottom) phases using OIM Matrix™.

Features and Benefits

Realistic EBSD Pattern Simulations

- Dynamic diffraction effects and forward modeling used to accurately predict both scattering and diffraction intensities within EBSD patterns
- Experimental patterns can be easily compared with dynamic simulations

Dictionary Indexing

- Template matching provides improved performance over traditional Hough-based indexing
- Integrated into OIM Analysis™ for efficiency by using targeting indexing via data partitioning functionality

Master Pattern Database

- Includes over 450 calculated master patterns for immediate simulations
- Additional crystals can be simulated using crystal structure and atomic position information and added to database

Automatic Structure File Optimization

- Reflector list for traditional Triplet Indexing can be automatically created and optimized
- Makes analysis of new materials easier

EBSD Background Simulation

- Backgrounds can be simulated and used for standard image processing routines (Subtraction and Division) for optimized band detection
- Ideal for single crystals or for multi-phase samples where constituent phases have varying average atomic number and scattering intensities

Conclusion

OIM Matrix™ provides users with accurate simulations of EBSD patterns by applying dynamical diffraction theory. These simulations can be used for comparison against experimental patterns to find the best match, and improve indexing performance. These simulations can also be used to optimize material structure files to make analysis of new phases easier.