Correlative Indexing with Dynamic Template Matching – Hybrid EBSD - Pattern Matching coupled with Hough Indexing

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Commercial electron backscatter diffraction (EBSD) systems have used the Hough transform for the band detection and indexing of EBSD patterns (EBSPs). Hough-Indexing (HI) is highly optimised, fast and delivers excellent data across all EBSD applications. However, the development of effective EBSP simulations using dynamical electron diffraction theory has resulted in alternative indexing methods, such as Dictionary or Spherical indexing (DI/SI). These methods correlate experimental patterns with simulations, enabling effective indexing of extremely poor quality EBSPs, albeit with significant computational overheads.

A newly developed alternative to DI or SI employs a hybrid approach, i.e., using the results from HI for subsequent refinement via pattern matching methods. This combines the benefits of both approaches. Hybrid pattern matching has been developed to achieve a fast, effective analysis tool enabling:

- Improved angular precision down to 0.01°
- Improved discrimination of crystallographically similar phases
- Indexing of EBSPs that could not be indexed using HI
- New information, such as crystal polarity/phase domains

The hybrid pattern matching methods described use a fully dynamic approach to indexing, generating the necessary pattern simulations 'on the fly' – this method, known as "Dynamic Template Matching" (DTM) has multiple benefits over conventional DI/SI, such as immediate set up, effective analysis of complex, multi-phase materials and a robust, transparent metric for data quality using the normalised cross correlation coefficient.

In this talk the DTM approach is introduced, and the effectiveness and advantages are demonstrated using examples from a diverse range of application fields.