"The Physics of EBSD"

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The Bloch wave approach to dynamical electron diffraction can be used to gain fundamental insights into the basic mechanisms of pattern formation in EBSD.

In addition to the description of the actual intensity distribution in Kikuchi bands, this includes the formation of higher order Laue zone (HOLZ) rings as a transmission resonance phenomenon, the excess-deficiency effect due to anisotropic backscattering, and the contrast reversal of Kikuchi bands due to Bloch wave specific "anomalous" absorption.

Real-space views of the Bloch wave field inside the diffracting crystal allow to visualize how the unit cell of the crystal is systematically sampled by different parts of a Kikuchi band. This unit cell sampling process leads to site-specific Kikuchi band profiles which have been observed using the atomic recoil effect in electron Rutherford backscattering measurements from Al_2O_3.

Energy-resolved measurements of Kikuchi band profiles from Si reveal to what extent elastically and inelastically scattered electrons contribute to the Kikuchi band contrast depending on the measurement geometry.