LMS Seminar

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Field Dislocation Mechanics and its application to electron microscopy

Vincent Taupin

Université de Lorraine

ABSTRACT

A multiscale dislocation plasticity model that accounts for the presence and evolution of geometrically necessary dislocation densities in crystalline microstructures is presented [1]. These dislocation densities can be used to model single dislocation lines but also the self-organization of dislocation ensembles in the course of plastic deformation. They are introduced through the Nye dislocation density tensor [2]. Incompatible elastic distortions result from the presence of these dislocation densities and induce long-range internal stresses. In this presentation, the model and the development of numerical spectral algorithms based on fast Fourier transforms to approximate the solution of field equations are briefly introduced [3]. Then, the application of the model to electron microscopy data is presented. First, a recent high-resolution EBSD algorithm, and the comparison between the measured and simulated elastic fields for dislocations in a GaN semi-conductor material are shown [4]. Second, the model is used to obtain the internal stresses and strains of dislocation networks in olivine as characterized by 3D dislocation electron tomography [5].

BIOGRAPHY

Vincent Taupin is CNRS research scientist at the Laboratoire d'Étude des Microstructures et de Mécanique des Matériaux (LEM3) at Metz, since 2010. His research activities focus on the modeling of plastic deformation of metallic and crystalline microstructures. V. Taupin aims at developing models that can capture the development of characteristic features of plasticity such as dislocation self-organized structures, size effects and kinematic hardening, and models for the study of crystal defects (dislocations, disclinations, grain boundaries) at a finer scale. Recently, he has spent time with colleagues developing and using advanced characterization techniques in the electron microscope (scanning and transmission microscopy) and tried to make the developed models complementary to experimental observations.

REFERENCES

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