From Dislocation Plasticity to Compaction of Snow – Internal Length Scales and Size Effects

Stefan Sandfeld*

* TU Bergakademie Freiberg, Chair of Micromechanical Materials Modelling (MiMM),
Lampadiusstr. 4, 09596 Freiberg, Germany
e-mail: stefan.sandfeld@tu-freiberg, web page: http://tu-freiberg.de/fakult4/imfd

ABSTRACT

Modelling and simulation of small-scale systems and devices during plastic deformation can complement experiments in a powerful way: idealizing real systems and "switching on and off" of specific model details guides towards identifying relevant micromechanical mechanisms which are then responsible e.g. for a specific load-displacement response on the specimen scale. This approach becomes particularly interesting once the length scale of the system approaches the internal length scale of the underlying microstructure.

We start by showing how in nano- and microplasticity the average dislocation spacing or other microstructural elements can define such length scales. It will be demonstrated how the peculiarities of driven systems of dislocations (long-range interactions, self-organization, far-from-equilibrium system) become directly visible in form of size effects, dislocation pattern formation or jerky flow.

The second part of this presentation considers deformation of snow, which is a material with a very high homologous temperature. We will demonstrate, that again the particularities of the microstructure which contains internal length scales may give rise to completely unexpected complex behaviour.