

SCALE-DEPENDENT PLASTICITY: EXPERIMENTS, THEORY AND NUMERICAL MODELING

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ABSTRACT

The strength of metallic engineering materials is highly dependent on the involved length scales as e.g. the grain diameter or the characteristic dimensions of micro specimens. These length scales give rise to a large variety of size effects. Since these size effects, as e.g. size dependent hardening, have a strong impact on the mechanical response of micro devices, their experimental and theoretical investigation is presently subject to extensive research and also exhibits a strong technological relevance. Micro-experiments provide the basis for profound understanding and development of theories concerning mechanisms that control the macro- and mesoscopic material behavior. Since the observations can in general be traced back to dislocation-induced micro- and nano-mechanical phenomena, the physical description of plasticity is a complex multi-scale problem. A better understanding of the origin of microscopic material behavior as well as advanced scale-bridging techniques are needed to describe the collective behavior of vast numbers of dislocations in order to simulate larger mechanical systems. Additionally, the numerical discretization in space and time is generally involved and the simulations require highly efficient numerical algorithms.

This minisymposium invites international researchers from the fields of experimental dislocation observation and modelling and simulation of discrete and continuous dislocation microstructures. We have a strong focus on numerical solution strategies and on models that can provide input data as well as act as bench mark tests for numerical simulations. Furthermore, we encourage papers on strategies for transferring information from microplasticity experiments into simulations. The minisymposium is intended to be a platform for the presentation and discussion of recent research results that give new insights into the physical modeling of size-dependent plasticity theories and corresponding numerical strategies. Moreover, it is supposed to improve the mutual understanding and to foster a common language in a research field which is extremely broad due to the complexity and multi-scale nature of the subject.