

GRADIENT NANOMECHANICS: APPLICATIONS TO DEFORMATION, FRACTURE AND DIFFUSION IN NANOPOLYCRYSTALS

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Abstract

The initial experimental observations and modeling ideas advanced in the mid nineties at Michigan Tech (MTU) for the deformation and fracture of nanocrystalline (nc) and ultrafine grain (ufg) polycrystalline specimens in thin film and bulk configurations are first reviewed. This is done not only because these early results remain still largely unknown, but also because they have motivated recent experimental, theoretical and simulations work for nanophase materials. Next, a continuum nanomechanics framework is outlined for elasticity, plasticity and diffusion in nc's and ufg's and comparisons with experiments are provided. These experimental results concern stress-strain relations under varying grain size, strain rate, and temperature.

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