Motion of Connected Grain Boundaries and Stability of Nanocrystalline Systems

Lazar S. Shvindlerman[1,2] , Günter Gottstein[1]

[1]Institut für Metallkunde und Metallphysik, RWTH Aachen University

[2]Institute of Solid State Physics Russian Academy of Sciences

The presentation is dedicated to one of the major topics of modern materials science: evolution and stability of granular microstructures with special emphasis on fine grained and nanocrystalline materials. This problem is considered in the light of recent theoretical studies and computer simulations which provide evidence that the kinetics of connected grain boundaries might be essentially different from grain boundary kinetics. This effect is most prominent for fine grained and especially nanocrystalline materials. Major attention is paid to the contribution of grain boundary junctions (triple junctions and quadruple points) to grain microstructure stabilization. The results of recent experimental investigations of grain growth in nanocrystalline materials are discussed in the framework of developed approach.
The effect of faceting on the migration of high-angle boundaries is investigated. It is shown that the steady-state motion of a faceted boundary relates to a maximum dissipation rate of free energy.