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A Review on Accommodation Processes in Non-Equilibrium Grain Boundaries

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Abstract. The grain boundaries in ultrafine-grained materials, including nanostructured ones, are in a specific non-equilibrium state, which is associated with extrinsic grain boundary dislocations trapped during plastic deformation. This grain boundary state plays a significant role in the stability and evolution of many mechanical and physical properties of nanocrystalline materials. In the present review, accommodation of different components of non-equilibrium grain boundary structure resulting in a formation of a more equilibrium structure and associated with a decrease in the internal stresses is analyzed. These are spreading of lattice dislocations trapped by grain boundaries, relaxation of disordered dislocation walls, relaxation of ensembles of sessile and glissile extrinsic grain boundary dislocations. The main advantages and limitations of the models describing accommodation processes are overviewed. Application of the obtained results to nanomaterials is discussed.

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