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Incorporation of plasticity into the Landau-Ginzburg theory of martensitic phase transformations ROMAN GRÖGER, TURAB LOOKMAN, Los Alamos National Laboratory, Theoretical Division — The Landau-Ginzburg theory of martensitic phase transformations has been utilized to reproduce the evolution of elastic texture in defect-free materials undergoing structural phase transformations. Generalizations of this theory to phase transformations that are accompanied by significant plastic distortions (as in U_6Nb) have been little studied. We propose a simple model that demonstrates how to incorporate plasticity into the Landau-Ginzburg theory. In the presence of topological defects such as dislocations, the usual Saint Venant compatibility constraint becomes an incompatibility constraint and this is represented by a tensor field η_{ij}. In our case, the components of η_{ij} are expressed as gradients of the components of the Nye tensor that represent the dislocation density. The presence of dislocations induces large internal stresses in certain regions of the material, and these act as initiation sites for plastic deformation. When the external loading is applied, dislocations moving from these regions cause strain hardening that is detectable in experimental uniaxial measurements. This model serves as a starting point for further development of the framework of three-dimensional rate-independent theory of plasticity within the Landau-Ginzburg formalism.

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