M. Šilhavý: Phase Transitions with Interfacial Energy: Interface Null Lagrangians, Polyconvexity, and Existence

The paper proves the existence of equilibrium two phase states with elastic solid bulk phases and deformation dependent interfacial energy. The states are pairs (y, E) consisting of the deformation y on the body and the region E occupied by one of the phases in the reference configuration. The bulk energies of the two phases are polyconvex functions representing two wells of the substance. The interfacial energy is interface polyconvex. The last notion is introduced and discussed below, together with the interface quasiconvexity and interface null Lagrangians. The constitutive theory and equilibrium theory of the interface are discussed in detail under appropriate smoothness hypotheses. Various forms of the interfacial stress relations for the standard and configurational (Eshelby) interfacial stresses are established. The equilibrium equations are derived by a variational argument emphasizing the roles of outer and inner variations.