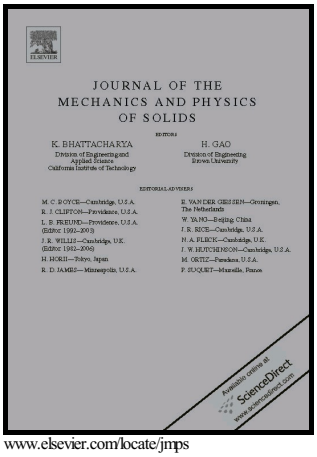

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An interface energy density-based theory considering the coherent interface effect in nanomaterials

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Abstract

To characterize the coherent interface effect conveniently and feasibly in nanomaterials, a continuum theory is proposed that is based on the concept of the interface free energy density, which is a dominant factor affecting the mechanical properties of the coherent interface in materials of all scales. The effect of the residual strain caused by self-relaxation and the lattice misfit of nanomaterials, as well as that due to the interface deformation induced by an external load on the interface free energy density is considered. In contrast to the existing theories, the stress discontinuity at the interface is characterized by the interface free energy density through an interface-induced traction. As a result, the interface elastic constant