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Summary: It is suggested a thermodynamic framework to describe plastic deformation in FCC metals at low strain rates and temperatures when the major mechanism of deformation is dislocation motion. The theory involves new thermodynamic parameters: dislocation polarization tensor, stress resistance tensor, entropy and temperature of microstructure. They are linked by constitutive equations. Entropy and temperature of microstructure are associated with the rate of slip avalanches and average energy drop in slip avalanches, respectively. The theory is illustrated by comparison with experimental data.

MSC:
74C05 Small-strain, rate-independent theories of plasticity (including rigid-plastic and elasto-plastic materials)
74C10 Small-strain, rate-dependent theories of plasticity (including theories of viscoplasticity)

Keywords:
dislocations; stress-strain curve; slip avalanches; acoustic emission; thermodynamics

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