Dislocations and inclusions in prestressed metals

The effect of prestress on dislocation (and inclusion) fields in nonlinear elastic solids is analyzed by extending previous solutions by Eshelby and Willis. Employing a plane strain constitutive model (for incompressible incremental nonlinear elasticity) to describe the behavior of ductile metals (the J2–deformation theory of plasticity), we show that when the level of prestress is high enough that shear band formation is approached, strongly localized strain patterns emerge, when a dislocation dipole is emitted by a source. These may explain cascade activation of dislocation clustering along slip band directions.

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