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The release of shear stress in metals under dynamic loading RADE VIGNJEVIC, Cranfield University, NEIL BOURNE, AWE, Aldermaston — Metals under shock loading relieve shear stress by slip after. This work focuses on the types of loading where a metal initially responds entirely elastically and plasticity with deformation mechanisms developing over time and determined by the material's state and microstructure. Finite kinetics in shock is mirrored in several commonly observed responses including elastic precursor decay and the measurement of shear stress histories during load. FCC and BCC metals have different kinetics, with those of BCC metals slower. A model, under development, is implemented here to depict the behaviour observed by assigning a finite time to the return of the state point from the quasi equilibrium yield surface to the equilibrium yield surface. This delays the softening of the material and reproduces observed response in the weak shock regime. The model is based on the assumption that formation and self-organisation of dislocation structures at various scales maximises dissipation rate (minimize the free energy) in the material. Initial validation of the model is performed on tantalum by comparing stress histories under shock and shock-less loading with experimental data in order to assess its ability to reproduce experimentally observed features.

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