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Analysis of the annihilation/renucleation mechanism for high velocity dislocations CHRISTOPHE DENOUAL, LAURIANNE PILLON, CEA, DAM, DIF — Properties of plasticity are governed by the motion of dislocations and by their interactions (or dislocation junctions). Among all possible reactions between dislocations, annihilation (ie reaction between dislocations of same circulation but opposite Burgers' vectors) is known as the strongest. However, in shock loadings, dislocation kinetic energy has to be considered in addition to the elastic one, which could notably changes the classical picture for strain hardening. We show in this study that inertial effects could overcome the annihilation reaction and allow for renucleation of a dislocation dipole from a completely annihilated one. To do so, full dynamic simulations using the Peierls-Nabarro Galerkin method are compared to dislocation dynamic simulations. For this latter, a closed-form expression for dislocation equation of motion, including relativistic and retardation effects is considered. It is demonstrated that : i) energy balance using classical expressions for kinetic energy and elastic energy fails to predict the renucleation mechanism, ii) the very high velocity needed to renucleate is due to a complex mechanism of wave emission during the interaction.

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