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Response of FCC and BCC Metals to High-Amplitude Dynamic Compression MARC MEYERS, UC San Diego, BRUCE REMINGTON, BRIAN MADDOX, Lawrence Livermore National Laboratory, EDUARDO BRINGA, Universidad Nacional de Cuyo, Argentina, HYE-SOOK PARK, Lawrence Livermore National Laboratory, CHIA-HUI LU, UC San Diego — The experimentally observed response of FCC and BCC metals to high-amplitude compressive waves is compared with analytical predictions using constitutive models based on dislocations and twinning and with molecular dynamics simulations. In FCC metals (Cu and Ni), the predictions of dislocation densities from a homogeneous nucleation model are close to those of molecular dynamics simulations. Both are orders of magnitude higher than experimentally observed residual dislocation densities. MD calculations predict a drastic decrease in dislocation densities upon unloading, bringing the values in agreement with measurements. For BCC metals (Ta), on the residual densities are close to predictions of Orowan dislocation multiplication. Due to the much higher Peierls-Nabarro stress, the MD simulations predict much lower dislocation densities than in FCC metals subjected to similar pressures. At higher amplitudes, both FCC and BCC metals experience extensive twinning. The threshold pressure for twinning is successfully modeled by constitutive model based on a critical shear stress for twinning, at the imposed strain rate and temperature. Research funded by UCOP/UC Labs Program.

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