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Deformation regimes in shocked nanocrystals: experiments and simulations[1] Y.M. WANG, E. BRINGA, A. CARO, M. VICTORIA, J. MCNANEY, J. HAWRELIAK, R. SMITH, B. REMINGTON, H. LORENZANA, Lawrence Livermore National Laboratory, Livermore, M. MEYERS, H. JARMAKANI, UC San Diego — Transmission electron microscopy (TEM) of shocked nc samples shows dislocations for pure Ni with grain sizes above 30 nm grain, even at 70 GPa, which is more than twice the twinning threshold for shock-twinning in polycrystalline Ni. On the other hand, new experiments on NiW show a rich behavior, with twins only at 9 nm grain size and both dislocations and twins at grain sizes above 50 nm. We interpret this as due to the relatively low stacking fault energy (SFE) of NiW. A semi-analytical model is presented which is consistent with the experimental changes in the slip-twinning transition with grain size and stacking fault energy. MD of shock waves in nc Cu and nc Ni, which have very different SFE, are also consistent with the experimental results. The experiments, model and simulations provide a deformation map for nc under shock loading.

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