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Dislocation Patterning and Dynamic Fracture in Shock-Loaded Tantalum and Uranium Alloys LUKE HSIUNG, Lawrence Livermore National Laboratory — Deformation substructures in fragments of bcc metals and alloys: Ta, Ta-2.5%W, Ta-10%W, and U-6wt%Nb recovered from HE-driven shock experiments; all were conducted under a peak pressure of ~30GPa, were characterized and analyzed using transmission electron microscopy (TEM) techniques. The relationships between dislocation patterning and dynamic fracture mode of the fragments are correlated. The results reveal that dynamic damage and fracture in bcc metals are intimately related to the reactions for dislocation patterning, such as deformation twinning and the formation of cell walls or sub-boundaries, which in turn are governed by the mobility of dislocations under dynamic-pressure conditions. Deformation twinning phenomenon becomes significantly enhanced in U-6Nb containing high-density and low-mobility dislocation structure. The embrittlement of U-6Nb under dynamic-pressure conditions is found to mainly be caused by the structural instability and the mutual collision of twin bands, which lead to the enhancement of spall-like damage. This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

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