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Microstructural Evolution and Phase Stability in Shock-Loaded Tantalum Single Crystals JIKOU ZHOU, CHENG SAW, RICKY CHAU, LUKE HSIUNG, Lawrence Livermore National Laboratory — Deformation of tantalum and tantalum alloys has been studied repeatedly in order to understand their constitutive behavior and microstructural stability under dynamic pressure conditions. Shock-induced microstructures including dislocation patterning, deformation twinning, and phase change have been reported in shock-deformed poly-crystalline tantalum, and the strain hardening of post-shocked polycrystalline tantalum was mainly attributed to deformation twinning. However, the underlying mechanisms for shock-induced deformation twinning remain unclear. In this presentation, we report the results of a systematic study, which investigate the microstructural evolution and mechanical properties of shocked tantalum single crystals. Shock impact experiments were carried out in a two-stage gas gun under three different pressures: 25 GPa, 50 GPa and 70 GPa. The effects of crystal orientation and pressure on deformation substructures and mechanical properties are investigated by analyzing shock-recovered samples using x-ray diffraction, nanoindentation, and transmission electron microscopy techniques. 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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