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Transition of deformation modes in Shocked Tantalum LUKE HSIUNG, Lawrence Livermore National Laboratory — Shock-induced twinning and α (bcc) $\rightarrow$ ω (hexagonal) phase transition in tantalum, which exhibits no clear solid-state phase transformation under hydrostatic pressure conditions, have been investigated. Since the domains of deformation twin and ω phase were frequently observed in regions containing high-density screw dislocations without dislocation cell structures, it is suggested that the shock-induced shear transformations (twinning and phase transformation) occur as alternative deformation modes to accommodate insufficient dislocation flow resulting from the exhaustion of dislocation multiplication when dynamic recovery processes for dislocation annihilation and cell formation become largely suppressed under dynamic pressure conditions. A physical mechanism based upon the overlapping of closely spaced dislocation loops nucleated from a jogged screw dislocation is proposed to rationalize the shock-induced shear transformations. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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