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Deformation Response of Copper Single Crystals under Shockless Loading Conditions[1] JAMES MCNANEY, BEN TORRALVA, KARL LORENZ, BRUCE REMINGTON, MARK WALL, MUKUL KUMAR, Lawrence Livermore National Laboratory — Recovery based observations of high pressure material behavior generated under laser based quasi-isentropic loading conditions are reported. Material, recovered from a high pressure, high strain rate laser based platform, was characterized to infer the deformation response of copper to changes in the loading path from the shock Hugoniot to one near the isentrope. Whereas the temperature, pressure and strain states along these two paths are essentially equivalent, the strain rates are considerably different and a significant difference in the active deformation mechanism is observed. Material loaded quasi-isentropically shows a residual dislocation cell structure at pressure that is well above the slip twin transition under shock loading. At even higher pressures the quasi-isentropic deformation mechanism transitions to twin formation. These results show that the high pressure slip-twin transition can be strongly affected by the loading path. The observations are rationalized by using a pressure dependent twinning threshold stress along with a strain rate dependent constitutive model.

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