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Metastability of the alpha and omega phases in shock-loaded titanium DAVID JONES, BEN MORROW, ELLEN CERRETA, Los Alamos National Laboratory — Under shock-loading titanium will go through a solid-solid phase transition from the alpha phase (HCP) to the omega phase (simple hexagonal). The onset of this transition is not well-defined, as there is a large scatter in the published data. We present a series of experiments where high purity titanium (99.999%) was shock-loaded in gas-gun driven flyer plate impacts. Rear free-surface velocity measurements reveal the transition begins at a stress of 10.1 GPa when loaded to a Hugoniot state of 15 GPa. The aforementioned scatter in existing data around this stress and the slow transformation kinetics in the velocity data suggests that at this state both phases are metastable. Samples were loaded to the same conditions and soft recovered for post-mortem microscopy. With electron backscatter diffraction techniques we observed that the recovered samples contain approximately 65% omega phase. Through texture analysis of both the alpha and omega regions we show that all remaining alpha is the original material, i.e. the sample never reached 100% omega and there is no phase-reversion during release. Further experiments are also presented where this pre-shocked, omega-heavy material was shocked again, showing how this changes the free-surface velocity profiles and kinetics.

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