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Characterization of several martensitic phase transitions under extreme conditions[1] MANLING SUI, Institute of Microstructure and Property of Advanced Materials, Beijing University of Technology, Beijing, 100124, China, SHUJUAN WANG, WEI ZHANG, PENGFEI YAN, Shenyang National Laboratory for Materials Science, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016, China — In shock-compressed α-iron, transmission electron microscopy (TEM) investigations revealed a refined microstructure with tale-telling features that are indicative of $\alpha \rightarrow \varepsilon \rightarrow \alpha$ sequential martensitic transformations, even though no ε phase was retained. The unique microstructural fingerprints enable a quantitative assessment of the volume fraction transformed during explosive loading. In a Ti–6Al–4V alloy, an unusual martensitic transformation from α-Ti to β-Ti occurred by a high-density current pulse, instead of the conventional martensitic transformation from β-Ti to α-Ti. A large amount of the high-temperature phase remained. By pulsed laser irradiation, a solid-state phase transition from the α to the γ phase of aluminum oxide was observed for the first time. High resolution TEM reveals that the transformation is achieved via the glide of quarter partial dislocations on every other basal plane of α-Al_2O_3. This martensitic transformation is associated with a positive volume change and substantial shear strain.

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