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Identifying and assessing high-pressure phase transition in iron by unique microstructure of $\alpha \rightarrow \varepsilon \rightarrow \alpha$ transitions[1] SHU-JUAN WANG, QIU-HONG LU, YONG-TAO CHEN, QING-ZHONG LI, YONG-BO XU, HAI-BO HU, MAN-LING SUI, INSTITUTE OF METAL RESEARCH, CHINESE ACADEMY OF SCIENCES, SHENYANG 110016, CHINA TEAM, INSTITUTE OF FLUID PHYSICS, CHINA ACADEMY OF ENGINEERING PHYSICS, MIANYANG 621900, CHINA COLLABORATION, BEIJING UNIVERSITY OF TECHNOLOGY, BEIJING 100124, CHINA TEAM — Unique nanotwinned α-Fe with threefold-symmetry characteristic was found in shock-compressed iron by using transmission electron microscopy (TEM). It was confirmed that the unique microstructure of α-Fe was formed in two martensitic transformations during shock treatment, i.e. the $\alpha \rightarrow \varepsilon$ phase transition under shock loading and the $\varepsilon \rightarrow \alpha$ phase transition during unloading. The threefold-symmetry characteristic nanotwinned α phase is only correlated to the existence of ε phase in high pressure during shock loading. Therefore, the volume percentage of the high pressure ε phase under shock loadings could be assessed by measuring the α grains with the unique feature. A direct method to identify and assess high-pressure phase transition in iron has been developed.

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