

MS27 Minerals and Materials Under Extreme Conditions

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Structural and chemical versatility in iron oxides under extreme conditions

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Abstract

Being the only geochemically profuse element in Earth's interior with a variable oxidation state, iron controls oxygen fugacity and affects all global planetary processes. Numerous iron oxides with unexpected compositions recently identified at high-pressure and high-temperature conditions demonstrate rich crystal chemistry and intriguing physical properties.

We applied methods of single-crystal X-ray diffraction and Moessbauer spectroscopy in laser-heated diamond anvil cells to study phase transformations, chemical stability and crystal chemistry of compounds belonging to Fe-O system at pressures up to 200 GPa and temperatures over 3000 K. We observed that conventional iron oxides (FeO, Fe₃O₄ and Fe₂O₃) exhibit rich polymorphism at high pressures and high temperatures which is in significant degree governed by magnetic and electronic changes in Fe atoms. We will discuss how chemical, electronic, and magnetic states of iron oxides are influenced by pressure, giving rise to unexpected chemical reactions, structural and other types of transformations.