

Cerium's unusual behavior

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The cerium $\gamma \leftrightarrow \alpha$ phase transition was investigated using high-pressure, high-temperature angle-dispersive x ray diffraction measurements at ESRF, ID09 beamline, on both poly- and single-crystalline samples, explicitly addressing symmetry change and transformation paths. The isomorphic hypothesis of the transition is confirmed, with a transition line ending at a solid-solid critical point. The critical exponent is determined, showing a universal behavior that can be pictured as a liquid-gas transition. We further show an isomorphic transition between two single crystals (with more than 14% of volume difference), an unparalleled observation in solid-state matter interpreted in terms of dislocation-induced diffusionless first-order phase transformation. These observations represents an important step forward in achieving a reliable and unambiguous picture of the mechanism of phase transformation in cerium, an element archetypical of the localization-delocalization phenomenon encountered in f-electron systems.

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