

The Physical Properties of Lu_2O_3 under High-Pressure by X-ray Diffraction Method

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Recently, the crystal structures and phase behavior of lanthanide sesquioxides, Ln_2O_3 , under various conditions of temperature and pressure have been studied over many years by different research groups[1]. X-ray diffraction studies of B-type Sm_2O_3 , and Gd_2O_3 under high pressure directly confirmed that pressure induces a monoclinic (B-type) to hexagonal (A-type) structural transformation[1a, 1b]. However, an important thermodynamic parameter the B→A transition, namely the volume change ΔV , and also the equation of state of B-type Ln_2O_3 , were not available from these studies, because of the limited resolution of the energy-dispersive X-ray diffraction systems used[1a, 1b].

Figure 1 shows representative X-ray diffraction and standard pressure lines of internal gold patterns for the cubic structure of Lu_2O_3 at ambient pressure. Figure 2 shows representative X-ray diffraction and standard pressure lines of internal gold patterns for the cubic and monoclinic structures of Lu_2O_3 at 11.3 GPa. Figure 3 shows representative X-ray diffraction and standard pressure lines of internal gold patterns for the monoclinic structure of Lu_2O_3 at 26.9 GPa.

Summary, Lu_2O_3 in-situ angular-dispersive X-ray diffraction (ADXRD) measurement was performed in the BL01C2 beamline during Oct. 12~15, 2007. Cubic Lu_2O_3 was compressed in a symmetric diamond anvil cell at room temperature and studied in situ using angular-dispersive X-ray diffraction (ADXRD) method. A transition to a monoclinic phase began at 11.3 GPa and was complete at 26.9 GPa.

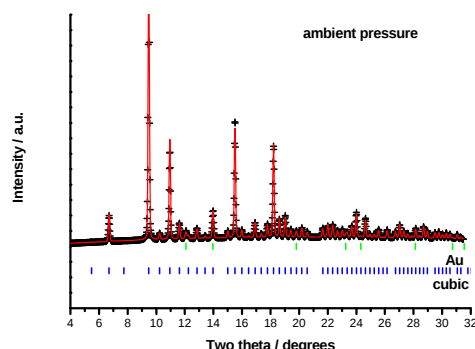


Figure 1. X-ray diffraction patterns of the Lu_2O_3 sample at ambient pressure.

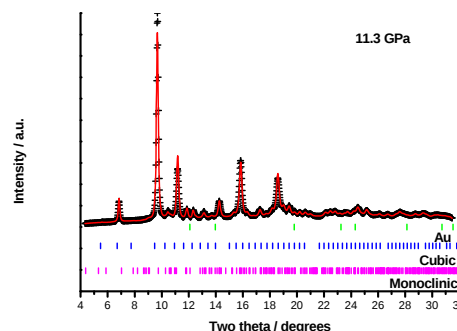


Figure 2. X-ray diffraction patterns of the Lu_2O_3 sample at 11.3 GPa.

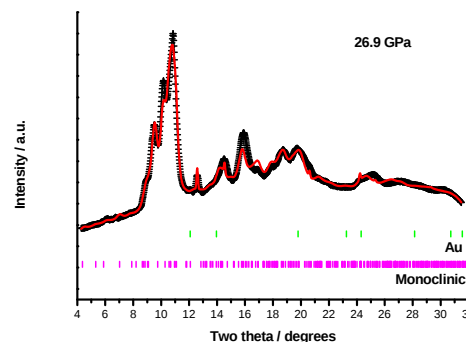


Figure 3. X-ray diffraction patterns of the Lu_2O_3 sample at 26.9 GPa.

[1] (a) T. Atou, K. Kusaba, Y. Tsuchida, W. Utsumi, T. Yagi, and Y. Syono, *Mater. Res. Bull.* **24**, 1171 (1989); (b) T. Atou, K. Kusaba, Y. Syono, T. Kikegawa, and H. Iwasaki, in "High-Pressure Research in Mineral Physics: Application to Earth and Planetary Science" (M. H. Manghnani and Y. Syono, Eds.), p. 469. American Geophysical Union, Washington, DC (1992); (c) G. Chen, N. A. Stump, R. G. Haire, J. B. Burns, and J. R. Peterson, *High Pressure Res.* **12**, 83 (1994).