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

Chih-Ming Lin (林志明)[1], Kung-Te Wu (吳恭德)[2], and Ching-Hsiang Tony Huang (黃慶祥)[3]

[1]Department of Science Education, National Hsinchu University of Education, Hsinchu, Taiwan
[2]Department of Physics, Soochow University, Taipei, Taiwan
[3]Department of Earth Sciences, National Cheng Kung University, Tainan, Taiwan

Lu_2O_3 in-situ XANES (X-ray Absorption Near Edge Spectroscopy) measurement were performed in the SP12B1 beamline during Dec. 10~14, 2007. Lu_2O_3 has a body-centered-cubic structure ~space group *Ia3*)(no.206) with 80 ions per unit cell [1]. Lu^{3+} ions are distributed between two distinct crystallographic sites: 75% and 25% occupy sites with *C*2 and *C*3*i* symmetries, respectively [2]. Lu^{3+} ions in both *C*2 and *C*3*i* sites possess distorted octahedral coordination geometries. Lu_2O_3 show C type in ambient pressure and B type in high pressure.

Figure 1 shows Lu L_{II}-edge XANES spectra of Lu_2O_3 at 300 K. The energy was calibrated using the data acquired simultaneously on a Lu_2O_3 foil at 300 K. The positions of the L_{II}-edge resonance peaks in the XANES spectra are shifted upward relative to that of pressure as Table I. On the other hand, x-ray-absorption spectroscopy at the *L* edge has been used to probe the density of states above the Fermi level as Figure 2 and Table II. We can suggest that the change of density of state in C and B type.

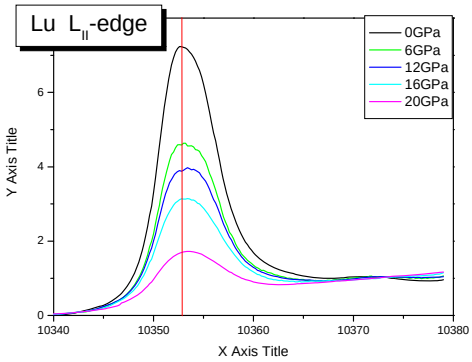

Figure 1. L_{II}-edge XANES spectra of Lu_2O_3 samples at 300 K.

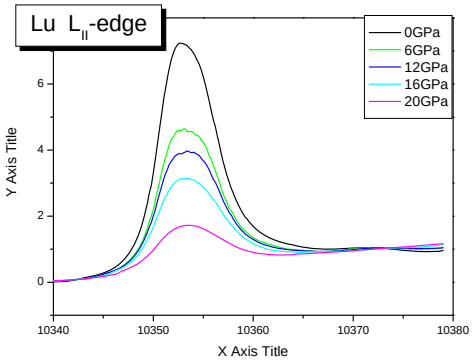

Figure 2. The density of state v.s. pressure.

Pressure (GPa)	White line (eV)
0	10352.6
6	10353
12	10353.4
16	10353.4
20	10353.6

Table I. The white line v.s. pressure.

Pressure (GPa)	Density of state (area)
0	75.45
6	57.15
12	52.85
16	46.43
20	34.9

Table II. The density of state vs pressure

Reference：

1、L. Eyring, in Handbook on the Physics and Chemistry of Rare Earths, edited by K.A. Gschneidner, Jr. and L. Euring North-Holland, Amsterdam, Vol. **3**, Chap. 27 (1979).
2、M. Faucher and J. Pennetier, Acta Crystallogr., Sect. B: Struct. Crystallogr. Cryst. Chem. **36**, 3209 (1980).