

XAFS Study on Electronic Structure in Eu@C₆₀

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A series of metal endohedral C₆₀ (M@C₆₀, M: atom), in which M exist in the inside of C₆₀ cage, are of very interest. Since 1995, we reported the preparation of MC₆₀ by an arc-discharge method and its effective extraction with aniline.¹⁻⁵⁾ Recently, we have determined the position of Eu atom in EuC₆₀ by Eu L_{III}-edge XAFS.⁶⁾ This result showed that Eu atom lies on the off-center position in the inside of the C₆₀ cage. Consequently, EuC₆₀ could be represented as Eu endohedral C₆₀, Eu@C₆₀. In the present study we have studied the oxidation state of Eu atom from XANES spectrum around Eu L_{III}-edge for Eu@C₆₀.

We found that the soot prepared by an arc-heating of Eu₂O₃/graphite composite rods (Toyo Tanso; Eu₂O₃ concentration of 0.8 mol%) exhibited a pronounced peak ascribable to Eu@C₆₀⁺ with weak peaks for C₆₀⁺, C₇₀⁺ and EuC₇₀⁺ in the laser desorption time-of-flight (LD TOF) mass spectrum. Therefore, it is expected to obtain the information on the oxidation state of Eu atom by XANES. Eu L_{III}-edge XANES spectra for Eu@C₆₀ soot were measured at room temperature in the transmission mode with a Si(111) monochromator at BL01B1 in SPring-8. The Rh mirror was inserted to eliminate the harmonics.

Figure 1 shows the XANES spectra around Eu L_{III}-edge for Eu@C₆₀ and Eu₂O₃. Two components which could be assigned to Eu²⁺ and Eu³⁺ were observed in the XANES for Eu@C₆₀. On the other hand, a single peak of Eu³⁺ was observed Eu₂O₃. These results suggest that the Eu atom in Eu@C₆₀ has mixed oxidation state of +2 and +3. This oxidation state is different from that of the Eu atom in Eu@C₈₂ in which the oxidation state of Eu atom is presented to be +2 from the electronic absorption spectrum.⁷⁾ The difference in the

oxidation states between Eu@C₆₀ and Eu@C₈₂ gives new interesting problem.

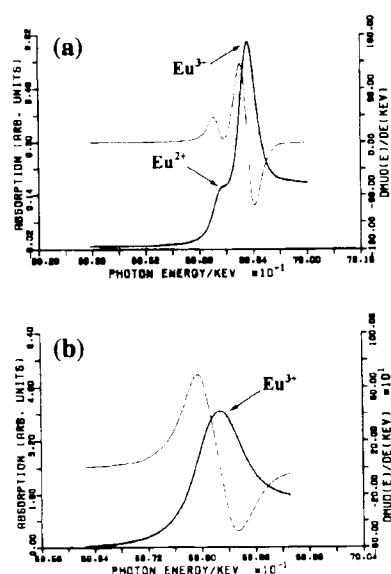


Figure 1. XANES spectra for (a) Eu@C₆₀ and (b) Eu₂O₃.

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