

XAFS Study on Electronic Structure in $\text{Eu}@\text{C}_{60}$

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A series of metal endohedral C_{60} ($\text{M}@\text{C}_{60}$, M: atom), in which M exist in the inside of C_{60} cage, are of very interest. Since 1995, we reported the preparation of MC_{60} by an arc-discharge method and its effective extraction with aniline.¹⁻⁵⁾ Recently, we have determined the position of Eu atom in EuC_{60} by Eu L_{III}-edge XAFS.⁶⁾ This result showed that Eu atom lies on the off-center position in the inside of the C_{60} cage. Consequently, EuC_{60} could be represented as Eu endohedral C_{60} , $\text{Eu}@\text{C}_{60}$. In the present study we have studied the oxidation state of Eu atom from XANES spectrum around Eu L_{III}-edge for $\text{Eu}@\text{C}_{60}$.

We found that the soot prepared by an arc-heating of Eu_2O_3 /graphite composite rods (Toyo Tanso; Eu_2O_3 concentration of 0.8 mol%) exhibited a pronounced peak ascribable to $\text{Eu}@\text{C}_{60}^{+}$ with weak peaks for C_{60}^{+} , C_{70}^{+} and EuC_{70}^{+} 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 $\text{Eu}@\text{C}_{60}$ 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 $\text{Eu}@\text{C}_{60}$ and Eu_2O_3 . Two components which could be assigned to Eu^{2+} and Eu^{3+} were observed in the XANES for $\text{Eu}@\text{C}_{60}$. On the other hand, a single peak of Eu^{3+} was observed Eu_2O_3 . These results suggest that the Eu atom in $\text{Eu}@\text{C}_{60}$ has mixed oxidation state of +2 and +3. This oxidation state is different from that of the Eu atom in $\text{Eu}@\text{C}_{82}$ 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 $\text{Eu}@\text{C}_{60}$ and $\text{Eu}@\text{C}_{82}$ gives new interesting problem.

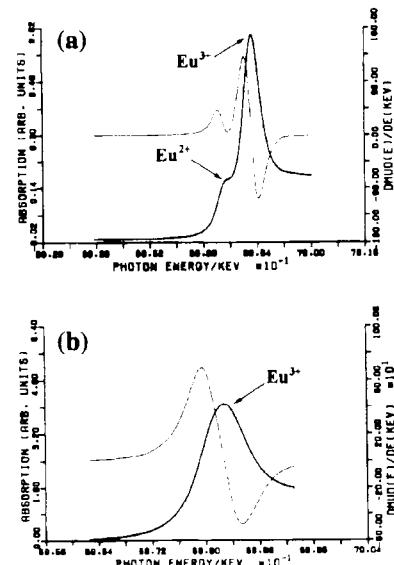


Figure 1. XANES spectra for
(a) $\text{Eu}@\text{C}_{60}$ and (b) Eu_2O_3 .

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