

Carbon *K*-edge NEXAFS study of carbonaceous matter in the Allende (CV3) carbonaceous chondrite

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Introduction

Various techniques, such as X-ray diffraction, Raman spectroscopy, and pyrolysis gas chromatography, have been applied to the characterization of the carbonaceous matter in carbonaceous chondrites. The major fraction of this matter is solvent insoluble macromolecular matter. Recently, some researchers have begun to use XANES spectra for the characterization of some extraterrestrial carbonaceous materials [1, 2, 3].

In this investigation, we tried to apply the XANES technique to the evaluation of the degree of graphitization of the carbonaceous matter, and the thermal history of its parent bodies.

Experimental

The Allende carbonaceous chondrite (CV3; Carbon *ca.* 0.3 %) was powdered and pressed on the copper plate (10mm × 10mm × 1mm). This chondrite has been moderately heated in its parent body [4]. A commercial highly oriented pyrolytic graphite (HOPG) crystal was used as a standard. Carbon *K*-shell excitation spectra were observed at the beamline BL-13C.

Results and Discussion

The XANES spectra of HOPG (Figs. 1a, b) were observed satisfactorily, showing dependence on angle of X-ray incidence, and the spectrum of Allende (Fig. 1c) shows a strong C=C π^* resonance at 285 eV, which is characteristic of aromatic carbon, in accord with the previous reports on some extraterrestrial carbonaceous materials [1, 2, 3]. In the case of Allende, the spectrum does not depend on angle of X-ray incidence.

However, the absorption intensity of the resonance at 285 eV is stronger than that of above the carbon edge, which reflects the total carbon number density. Cody III et al. (1999) reported that in the case of Murchison (CM2), the intensity above the carbon edge was comparable to that of the 285-eV feature [1]. These suggest that the size of carbonaceous matter in Allende is smaller than that in Murchison, although Allende is a moderately heated chondrite and the size of its carbonaceous matter should be expected to be larger than that of Murchison. The reason of this disagreement remains unclear.

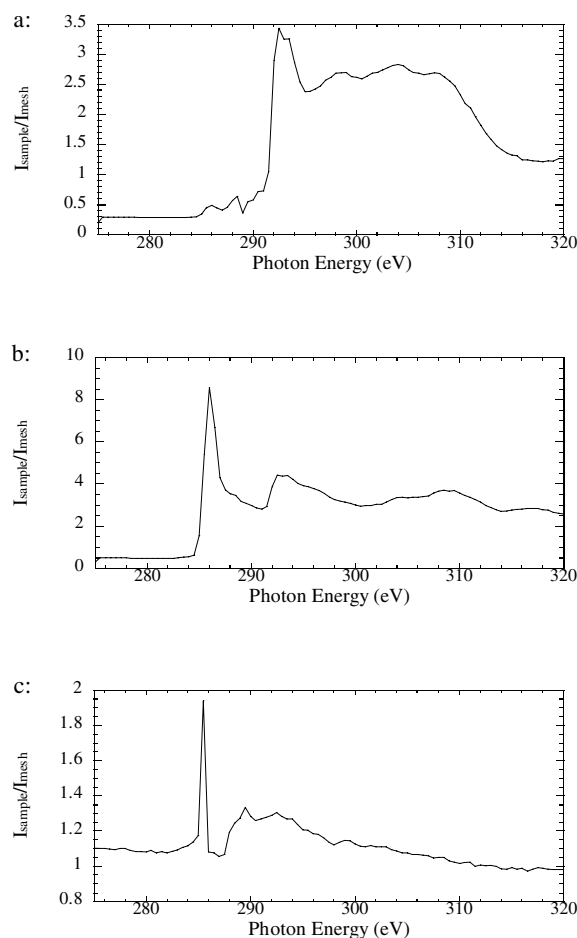


Fig 1. Carbon *K*-edge XANES spectra
a: HOPG $\theta = 90^\circ$, b: HOPG $\theta = 30^\circ$, c: Allende
 θ = angle of X-ray incidence

References

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