

Soft X-Ray Absorption Spectroscopy for Soft Matter

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Recently we started to study soft matter with soft x-ray, whose energy region covers K-edge energies of light elements such as carbon, nitrogen and oxygen. Local chemical environments of liquid sample in a liquid cell¹⁾ was investigated by x-ray absorption spectroscopy (XAS).

1. Soft X-Ray Absorption Spectroscopy for Liquid-Crystal Materials

The liquid-crystal material is one of the most important soft matter. In addition to gas, liquid and solid phases, liquid-crystal materials have liquid-crystal phase between solid and liquid phases. In the case of nematic liquid-crystal phase, the rod-shaped organic molecules have no position order, but they

self-align to have long-range directional order with their long axes roughly parallel. To investigate a change of local chemical environments caused by a phase transition, we measured XAS spectra of liquid-crystal materials at carbon and nitrogen K edge in solid, liquid-crystal and liquid phases.

In XAS spectra at carbon and nitrogen K edges, we find several peaks which are corresponding to core excitations such as 1s-to- π^* core excitations. We assigned these peaks to each core excitations with the help of a quantum chemical program, StoBe. The peak intensities and structures of XAFS spectra are slightly different for each phase of sample. We obtained results suggesting that π - π interactions of two molecules become weak after a phase transition from solid to liquid-crystal phases.

Reference

- 1) M. Nagasaka, H. Yuzawa and N. Kosugi, *J. Spectrosc. Relat. Phenom.* **200**, 293 (2015).