

Chirality control of amino acid films using circularly polarized soft X-rays - Toward a possibility of asymmetric radiation chemistry -

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Introduction

In the energy region of ultraviolet light, asymmetric decomposition is known to be originated from the difference in absorption cross section for the right and left circularly polarized light; larger the absorption cross section, larger the decomposition [1, 2]. On the contrast, in the soft X-ray energy region, asymmetric reaction has never been observed yet, probably because of so tiny difference in absorption cross section for right and left circularly polarized light.

Here we report our preliminary results of spectroscopy of chiral molecules and trial of asymmetric reaction caused by soft X-rays.

Spectroscopy of R-thalidomide

Evaporated thin films of R-thalidomide of which thickness was about 80 nm were prepared on Au films deposited on Si substrate. Fig. 1 and 2 show drain current spectra measured at BL-16A2.

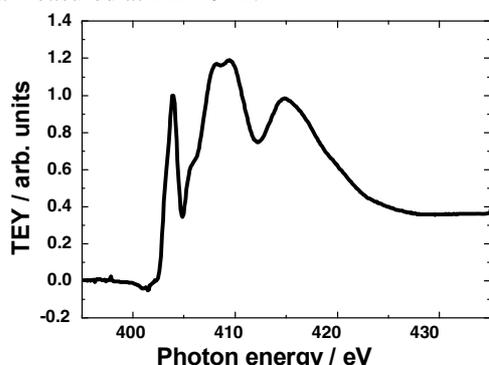


Fig. 1. Drain current spectrum of R-thalidomide.

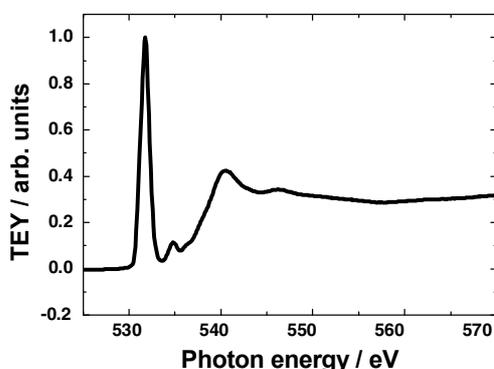


Fig. 2. Drain current spectrum of R-thalidomide.

As seen from the figures 1 and 2, characteristic NEXAFS peaks near the nitrogen K-edge and oxygen K-edge were observed. Next time we will try to observe asymmetric reaction tuning at each NEXAFS peak.

Asymmetric reaction of alanine films

Evaporated thin films of DL-alanine were prepared on Au film on SiO₂ glass substrate. Diameter and thickness of DL-alanine film was about 11 mm and 1 μm, respectively. In order to make the spot size maximum, optical component was adjusted. Achieved maximum spot size was about 3x8 mm². Fig. 3 shows drain current spectra of a DL-alanine film before and after irradiation of 2.2 x 10¹⁶ photons at 532.5 eV. As seen from the figure, the film was strongly decomposed after irradiation. In spite of the strong decomposition, no asymmetry was detected by the high performance liquid chromatography analyses. We think this phenomenon was due to the main contribution of secondary electrons. In this preliminary experiment, 1 μm of thickness was too large to introduce the severe charge up. A new strategy will be necessary to obtain a good result.

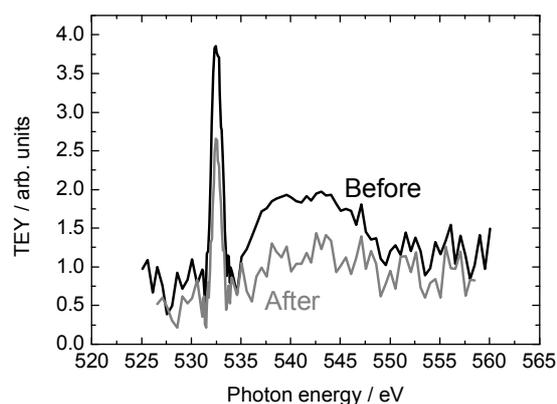


Fig. 3. Drain current spectrum of DL-alanine.

Reference

- [1] H. Nishino et al., JACS 124(2002)11618-11672.
- [2] U. J. Meierhenrich *et al.*, Angewandte Chemie International Edition 44(2005) 5630-5634.

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