Observation of the Structure of Materials by Refraction Contrast Imaging at BL19B2

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Three kinds of materials (rubber, metal, and insect) were observed by refraction contrast imaging in the third experimental batch located at 111m from the source. In order to perform time-resolved observation, refraction contrast images were taken with x-ray TV camera at object to camera distance of a few meters. X-ray was monochromatised to 20 or 33keV.

Figure 1 (a) shows refraction contrast image of foams in aluminum for shock absorbers and Fig.1 (b) shows an image of bubble structure in rubber for electronic conductive rubber sheets. Samples were collapsed and deformation of the structures was observed at regular intervals of 2 sec. Then, it was clearly observed that foams in aluminum started to crush from the top and bottom and the center part crushed at last. Fig.1 (c) shows an image of German cockroach, Blattella germanica (L), given an invertebrate pest. The bubble in the guts is indicated by arrow. Big or many bubbles were observed in a dead or dying cockroach.

This experiment was performed in the trial use project to improve activities of industrial users.

Local structure of fuel cell electrode-catalysts by XAFS

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A direct methanol fuel cell (DMFC) is an attractive fuel cell for a wide range of application from automobile to mobile phone. Pt or Pt alloys are widely used for the electrode catalysis of DMFC. One of the biggest problems of the DMFC is the adsorption of CO, generated at anode reaction, on the surface of the Pt electrode catalyst. Pt-Ru alloys are used to prevent CO poisoning. Nevertheless, Pt and Ru are expensive elements. There are many efforts to decrease the amount of Pt and Ru in electrode catalysts. In this study, Pt and Ru substituted polyoxometalates such as [(n-C6H13)3N]H2SiRuW1O10 were proposed as new materials. This material is found to show high catalytic efficiency for methanol oxidation, but the crystal size is too small for the single crystal structure analysis.

Figure 1 shows the Fourier transforms of W LIII EXAFS spectrum of [(n-C6H13)3N]H2SiPrRuW1O10 (1) and Ru K EXAFS spectrum of [(n-C6H13)3N]H2SiRuW1O10 (2) in (a) and (b), respectively. The spectrum (a) has large peaks at around 2 Å due to W-O, and at 3.6 and 4.5 Å due to W-W. The spectrum (b) has large peaks at around 2 Å due to Ru-O, and at 3.7 and 4.2 Å due to Ru-W. In addition, these EXAFS spectra are identical to that of [PW12O40]6-, which was previously reported [1]. These results indicate that the first and second nearest neighbor structure of the tungsten site in (1) and ruthenium site in (2) are identical, that is, the anion structure of (1) and (2) are identical and ruthenium in (2) are successfully uptake to polyanion and substituted for tungsten.


Figure 1. Fourier transforms of EXAFS spectra, measure at room temperature.