A3-08 Advanced Infrared Spectroscopic Techniques for Investigating Water-Polymer Interactions

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Infrared spectroscopy is a technique to study the bonding state of various compounds through molecular vibrations and is widely used for materials analysis. Synchrotron radiation (SR) is an electro-magnetic wave emitted from an electron traveling at almost the speed of light. The SR is well known for its use of high-energy light, especially X-rays, but it also includes low-energy infrared light (IR). The IR-SR has a characteristic of high brilliance compared to a conventional IR thermal radiation source, and it covers over a wide bandwidth from near IR to far IR. The feature of IR-SR is useful for microspectroscopy and infrared spectroscopy in a variety of sample condition. In the present study, humidity-controlled infrared spectroscopy was applied to materials which exhibit functions in aqueous environments, and the state of water and the interaction between water and materials were analysed to elucidate the mechanism of the function. The IR experiments are carried out at IR beamline BL43IR in SPring-8.

Fig. 1 shows a schematic illustration of the humidity control cell used in this study, where the space inside the cell is filled with nitrogen gas mixed with water vapor and the humidity is monitored by a humidity sensor. The cell can be used in the wavenumber range of 8000 to 150 cm-1, which is a full wavenumber range covered by BL43IR. Detectors, window materials, and other optical components are changed as necessary depending on the wavenumber region.

I introduce several investigations in the presentation. One of them is the study about PMEA (poly(2-methoxyethyl acrylate)) (1), that has a blood compatible property and is used as a coating material to prevent blood adsorption. We measured absorption spectra by changing humidity. The OH stretching band are shown in upper left of Fig.2. Lower left panel in Fig.2 shows the results of the theoretical calculation which examine the correlation between the OH stretching frequency and the electric field sensed by the H atom. From these results, the configurations of water molecules are discussed. A model is illustrated in right panel in Fig. 2.

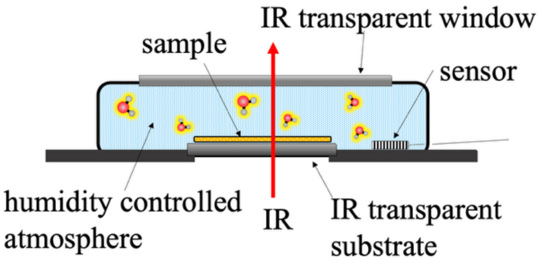

Fig.1 Schematic illustration of humidity control cell.

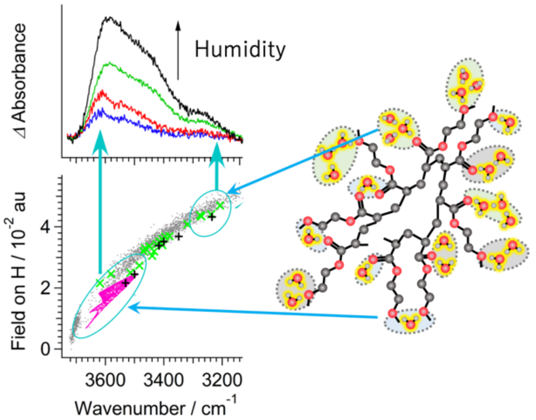

Fig.2 (upper left) OH stretching band in infrared spectra. (lower left) Electric field on H atom are plotted versus wavenumber of OH stretching mode. (right) Illustration of PMEA and water molecules.

1) Y. Ikemoto, Y. Harada, M. Tanaka, S. Nishimura, D. Murakami, N. Kurahashi, T. Moriwaki, K. Yamazoe, H. Washizu, Y. Ishii, H. Torii, *J. Phys. Chem. B*, **2022**, *126*, 4143.

PROFILE

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I obtained my PhD in Science from Department of Physics, Graduate School of Science, Tohoku University in 1998, spent 3 years as a postdoctoral fellow, and have been working at JASRI since 2001. I am a beamline scientist of the infrared beamline BL43IR at SPring-8, where I support various research projects utilizing infrared synchrotron radiation and develop equipment for advanced infrared spectroscoy.

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