

INDUSTRIAL



In 2011, seven contract beamlines for industrial application were in operation, and the total number of corporate users in all of SPring-8 decreased to 3088 from 3,471 in 2010. It is considered that the reason behind the 10% decrease in the number of corporate users is the influence of the Tohoku Earthquake that occurred on March 11, 2011. The issue on energy attracted much attention in the Japanese society after the earthquake, and companies struggled to develop technologies for energy generation, energy storage, energy saving, and energy control. Thus, the major topics of this issue are investigations on the storage, generation, and saving of energy.

In the present issue, six topics have been chosen to represent the works carried out in Industrial Applications. The first four topics are in the field of energy, and the other two topics are investigations on fibers. We selected these topics in XAFS, grazing-incidence X-ray diffraction, XMCD, X-ray topography, microbeam X-ray diffraction and FT-IR to introduce the diversity of industrial applications of SPring-8.

The first topic by Takamatsu is the application of total-reflection fluorescence XAFS at BL01B1 and BL37XU to investigate phenomena occurring at the interface between a LiCoO_2 electrode and an electrolyte solution of a Li-ion battery. In his experiment, incident X-rays impinged on the electrode interface at an angle smaller than the critical angle for total reflection, in order to extract the interfacial phenomena. He successfully observed the reduction of Co ions at the surface of the LiCoO_2 electrode with an organic electrolyte solution. This irreversible behavior, which was also observed at the surface of LiCoO_2 during the first charge/discharge process, may indicate the start of the deterioration of Li-ion batteries.

APPLICATIONS

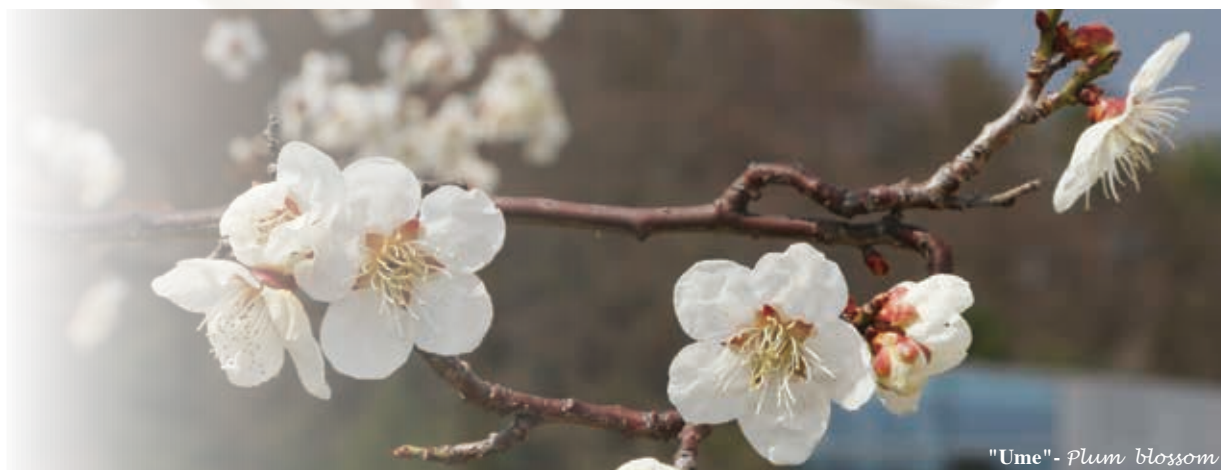
Recently, organic solar cells have been paid considerable attention since the easy and cheap production of flexible and large-area cells is expected. The crystallinity and crystalline orientation of organic thin films strongly influenced the performance of solar cells, as does the type of organic material itself. Drs. Osaka and Takimiya found that bulk-heterojunction solar cells composed of a novel semiconducting polymer based on naphthobisthiadiazole (PNTz4T) and [6,6]-phenyl C61-butyric acid methyl ester (PC61BM) have high power conversion efficiencies. Good crystallinity and the desired crystalline orientation of the blended thin film of PNTz4T and PC61BM were revealed by a grazing-incidence X-ray diffraction experiment at BL19B2.

The strongest permanent magnet in the NdFeB magnet widely used in motors and sensors. In particular, large numbers of NdFeB magnets are used in motors in both electric and hybrid electric vehicles. The third topic, investigating the texture of NdFeB magnets by XMCD, was performed at the contract beamline BL16XU established by electronics, steel, and automobile companies. Dr. Nambu and his colleagues found a clear relationship between magnetic moment and Nd concentration in simultaneously obtained Nd L_{II} XMCD and fluorescence yield data.

Silicon carbide (SiC) bipolar devices (e.g., IGBT and p-n diodes) are promising candidates for next-generation high-voltage power applications in various industrial, traffic, automobile, and power-transmission systems. The fourth topic concerns the application of X-ray microbeam three-dimensional topography at BL24XU to develop depth-resolved crystallographic analysis of SiC crystals.

The other two topics are investigations on fibers. Dr. Matsuba studied the shear-induced conformational fluctuations in polystyrene melts at BL43IR, since the final properties of polymer fibers strongly depend on the processing history, such as the external fields applied in extrusion or injection. Prof. Tashiro separately determined Young's modulus of skin and core parts of monofilaments in carbon fiber by microbeam X-ray diffraction at BL47XU and BL03XU. I am very happy for this opportunity to introduce the first research conducted at contract beamline BL03XU established by the Advanced Softmaterial Beamline Consortium.

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"Ume"- plum blossom