Industrial


"Kobushi" - *Magnolia*

Industrial use of SPring-8 is quite unique in the global SR community in terms of the scope of industrial areas and the number of industrial users. Reflecting the industrial structure of Japan, companies in electronics, automobile, hard/soft materials, energy & environment, pharmaceutical, and consumer goods conduct experiments for their critical research programs at various beamlines in SPring-8. The latest statistics for FY2012 indicate that 32% and 20% of research proposals conducted at contract and public beamlines, respectively, are submitted by leading researchers from the private companies. In addition, researchers from public and academic entities lead joint projects with their industrial partners, and actively conduct measurements at SPring-8 beamlines. The following five articles illustrate such activities.

Organic Semiconductors: H. Fukidome, M. Kotsugi, and H. Hibino, from Tohoku University, SPring-8/JASRI, and NTT Basic Research Laboratories, respectively, studied graphene epitaxy intensively at BL07SU, BL17SU, and BL23SU to develop graphene-silicon fusion devices. They conducted microscopic X-ray absorption spectroscopy (μ-XAS) measurements using a photoemission electron microscope (PEEM) at BL17SU on an operating graphene transistor to understand the electronic structure of the device. They also developed 3D Nano ESCA of the graphene transistor at BL07SU to elucidate the charge-transfer region at the interface of graphene and the source/drain electrodes.

Applications

Greenhouse Gas Control: To understand hydration structures around carbon dioxide molecules captured in aqueous amine solutions, H. Deguchi, N. Yamazaki, and Y. Kameda, from Kansai Electric Power Co., Mitsubishi Heavy Industries, and Yamagata University, respectively, applied an X-ray scattering capability at the leading industrial contract beamline BL16XU. Detailed analyses of the distribution function revealed hydrogen bond formations in solution. This work would contribute to the development of chemical absorption plants for large-scale CO_2 sources.

Automotive Catalysts: Catalysts composed of abundant base metals are highly demanded due to global concerns about the consumption of precious metals and to strengthen emission control. Y. Nagai from TOYOTA Central R&D Laboratories demonstrated the efficiency of an *operando* XAFS method, which is based on the quick-scanning XAFS (QXAFS) capability at their own contract beamline BL33XU. He discovered that simultaneous valence changes of copper and cerium atoms in Cu/CeO_2 of a three-way catalyst contribute to the improved reduction performance of nitrogen oxide in a rich/lean cycling condition.

Iron and Steel: D. Seo and M. Kobayashi from Toyohashi University of Technology and H. Toda from Kyushu University collaborated to successfully visualize a dual-phase structure of ferrite-austenite stainless steel using a phase contrast technique, namely, propagation-based imaging followed by a phase retrieval process. Their technique of 3D volumetric analysis is promising for a variety of duplex steel, such as ferrite-martensite and ferrite-cementite.

Electric Power Supply: The recent incidents in the aircraft industry have drawn public attention to the safety of lithium ion batteries when used improperly. K. Ohara, K. Fukuda, and E. Matsubara from Kyoto University developed two techniques of *in situ* XRD measurements of commercially available LIBs in normal use and have modeled cells in the extra-overcharge state at their contract beamline BL28XU.

SPring-8 would like to expand its application opportunities to include industrial areas that currently do not employ SR in Japan (e.g., food processing, agricultural and marine products, construction material, metal processing, and mineral resources).

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