

The Institute of Electronics, Information and Communication Engineers (IEICE)
Sponsored Lecture 2015

Development of Advanced Fuel Cells toward the Future Green Society Studied by X-Ray Absorption Fine Structure (XAFS) and Related Techniques

Date: 14th December 2015 (Monday)

Time: 9.30am – 12pm

Venue: CCU Seminar Room, Chancellery Building, MMU Cyberjaya

Organized by
IEICE Malaysia Section,
Co-hosted by
Multimedia University Malaysia

Lecture Abstract

Polymer electrolyte fuel cells (PEFC) have the potential to provide clean energy for powering vehicles, but improved performance and durability are needed for wide-spread commercialization. Advanced fuel cell catalysts can contribute to green and energy technologies and energy resource and environmental problems toward a sustainable society. Performances of nanoparticle cathode catalysts for oxygen reduction reactions (ORR) in PEFC are coupled with the structural and electronic kinetics/dynamics and three-dimensional spatial distribution of active nanoparticles in PEFC. Identifying the key issues relevant to the ORR activity and degradation of the cathode catalysts under the operating conditions is still a difficult challenge as “black box” because there are few suitable techniques for characterizing the potential-dependent electronic and bonding states of cathode catalysts with nanometer dimensions in the wet, heterogeneous and multiphase reaction field.

The talk documents how the nano-catalysts behave in automobile fuel cells by advanced x-ray absorption fine structure (XAFS) technique and complementary x-ray techniques (time-resolved XRD and near ambient-pressure hard x-ray photoelectron spectroscopy (NAP-HAXPES)) at the new beamline BL36XU we constructed at SPring-8, describing recent characterization of the dynamic transformation and spatial mapping of the Pt chemical species in the PEFC catalysis. The talk also presents typical examples of progress in PEFC catalyst fabrications, which may depend on a variety of key issues, such as nanoparticle size and shape (plane), surface roughness, compressive strain effect (bond distance), downward Pt d-band center, ligand effect (electron transfer), metal-oxygen bond strength, etc. These findings are expected to enable engineers to design and develop 'experiment based knowledge' electrode catalysts for the next generation fuel cells for applications including cars and electricity generation systems for homes.

Lecturer Biography



Yasuhiro Iwasawa

- Professor, Director (since 2010) of Innovation Research Center for Fuel Cells, The University of Electro-Communications
- Emeritus Professor, The University of Tokyo
- BSc (1968), MSc (1970), PhD (1973) from Department of Chemistry, Faculty of Science, The University of Tokyo
- Assistant Professor (1972), Lecturer (1977), Associate Professor (1981), Yokohama National University
- Associate Professor (1984), Professor (1986), Department of Chemistry, The University of Tokyo
- Dean (2005 – 2007) of Faculty of Science and Graduate School of Science, The University of Tokyo
- President of Catalysis Society of Japan (2005 – 2007)
- President of Surface Science Society of Japan (2004 – 2007)
- President of Chemical Society of Japan (2010 – 2012)
- Member of Science Council of Japan, Cabinet Office (since 2005)
- Head of Science and Technology section of Science Council of Japan (2008 – 2011)

Honors:

- Catalysis Society of Japan Award (1999)
- The Surface Science Society of Japan Award (2000)
- National Medal with Purple Ribbon from Emperor and Prime Minister (2003)
- The Chemical Society of Japan Award (2004)
- Honorary Member of Materials Research Society of India
- Honorary Fellow of Chinese Chemical Society
- Honorary Member of the Chemical Society of Japan

Publications:

- Books: "Tailored Metal Catalysts (Ed.)", Reidel, Dordrecht, 1986; "X-ray Absorption Fine Structure for Catalysts and Surfaces (Ed.)", World Scientific, Singapore, 1996; "Physical Chemistry for Chemical and Biological Sciences" (Transl.), Tokyo Kagaku Dojin, 2006; "XAFS Techniques for Catalysts, Nano materials, and Surfaces (Ed.)", Springer, New York, 2016; etc.
- Journal Articles and Reviews: more than 700 articles

Research Interests:

His main research interests come under the general term "Catalytic Chemistry" and "Surface Chemistry", but more specifically, new catalytic materials, fuel cells, in situ characterization, time-resolved and spatially-resolved X-ray absorption fine structure (XAFS), etc.