National Institute for Materials Science (NIMS)
Innovative Center of Nanomaterials Science for Environment and Energy (ICNSEE)
10th ICNSEE Seminar

Date and time: 2010. Nov. 16 (Tue) 14:30-17:00
Venue: Large Seminar room, Collaborative Research Bldg., 4F, Namiki Site, NIMS

Program and Abstract:

14:30-15:05 "Nanotechnology for Electrochemical Analyses: Rationally-Designed Nanomaterials and Microdevices"
Satoshi TOMINAKA, ICNSEE, Nano-interface Characterization Group

For the improvement of electrochemical devices, *e.g.*, fuel cells, batteries and solar cells, precise understanding of phenomena occurring on electrodes is of primary importance, especially for the use of nanomaterials; because their dimensions are comparable to double layer thickness and fluid films, and moreover their electronic structure are unique. Here, I focus on the former point. As common issues related to the effective use of nanomaterials, it will be necessary to design the materials more rationally on the basis of the better understanding of the phenomena occurring in the devises of interest. In this presentation, I will introduce my previous researches on electrochemical analyses on phenomena possibly occurring on nanostructured electrodes, and then, want to discuss ongoing researches based on micro-electrochemical devices which can precisely control several physical parameters associated with electrochemical reactions.

15:05-15:40 "Development and application of annular dark-field scanning confocal electron microscopy using a double aberration corrected microscope"
Ayako HASHIMOTO, ICNSEE, Nano-interface Characterization Group

Three-dimensional (3D) imaging and analysis with high resolution are often required in material science and engineering. Scanning confocal electron microscopy (SCEM) is one of promising 3D imaging techniques with TEM. In principle, SCEM enables us to perform optical depth sectioning by rejecting most of electrons from an out-of-focal plane in an object using a pinhole aperture at a conjugate plane. We developed a stage-scanning system by which only a specimen moves three-dimensionally maintaining a lens configuration and employed annular dark-field (ADF) SCEM that use only scattered electrons by an annular aperture. We finally succeeded in 3D imaging of carbon nanostructures. Further, it was found that the depth resolution of

ADF-SCEM depends on the probe size in the depth direction. Therefore, we established an ADF-SCEM trajectory using a double aberration-corrected electron microscope, which can provide a finer probe. Furthermore, we applied this imaging to analysis of catalytic nanoparticles on support materials.

15:40-15:50 Coffee Break

15:50-16:25 “Synthesis of nanostructured organic materials: From the Nanocar to polymer solar cells”

Yasuhiro SHIRAI, ICNSEE, Photovoltaic Materials Group

The continued quests to miniaturize machinery in our scientific and technological disciplines push forward the innovation of new molecule-based functional systems. In this talk, I would like to present our recent progress on the design, synthesis, and testing of the molecule-based functional systems: nano-machine “Nanocar” and other molecular/polymer electronic devices. At the end, I will try to explain how we apply the knowledge developed through these topics to our research at ICNSEE. Our primary goal at ICNSEE is the development of highly efficient polymer-based solar cells. Currently, we have two major strategies to achieve this goal: 1) design and synthesis of new functional molecules and 2) optimization of nano-structures in organic solar cells. Plans and some details on these strategies will be discussed.

16:25-17:00 “Large-scale production of carbon nanohorns and their application to fuel cells”

Yoshimi KUBO, ICNSEE, Fuel Cell Materials Group

Single-wall carbon nanohorns (SWNHs) have a unique aggregate structure which is a spherical shape like a sea urchin or a chestnut bur about 100 nm in diameter. Each SWNH consists of a single graphene sheet, just like the single-wall carbon nanotube, but the shape is horn-like. Thousands of SWNHs form the spherical aggregate. The structure would be advantageous for supporting fine particles of platinum catalyst for fuel cells because each SWNH aggregate has thousands of nanospaces between the horns. The power density of the direct methanol fuel cell was markedly increased by using SWNHs as catalyst supports. SWNHs are produced by CO_2 laser ablation of graphite. A large-scale production apparatus of SWNHs, which is indispensable for industrial applications, was also developed, demonstrating the production ability of more than 1 kg per day.