SEMINAR SERIES

International Institute for Carbon-Neutral Energy Research
Kyushu University

Title **Development of Pt and Pt-Alloy Electrocatalysts for the Next Generation Polymer Membrane Fuel Cell**

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Date & Time Friday, Oct. 26, 2012 4:00 p.m.

Place INAMORI Hall, Ito campus, Kyushu University

Abstract

Development of highly active and durable electrocatalysts for the oxygen reduction reaction (ORR) is one of the important subjects for wide applications of polymer electrolyte fuel cells, under reducing Pt amounts currently used to less than 1/10 level. There are a couple of approaches to the goal, i.e., increase in Pt specific activity by alloying with the second metals and that in the specific surface area by nano-sizing the catalyst particles and their effective use in the catalyst layer. We have first found noticeable enhancements by alloying of Pt with non-precious metals at ORR, which occur at Pt skin-layer formed on the alloy surfaces and modified in the electronic structure. It has been clarified that the enhanced dissociative adsorption of O_2 on Pt skin-surface is the principal reason for the superior catalysis, by using new modern spectroscopic analyses combined with electrochemical measurements at the alloys and Pt single electrodes. So, the first topic of my presentation is the mechanistic discussion, which becomes a clue for the design of new catalysts. The second topic is the enhancement of the activity by nano-sizing catalyst particles with no "particle-size effect". The third topic is the development of new "nanocapsule method for preparation of monodispersed pure Pt and Pt alloy particles supported on CB or graphitized CB with well-controlled size and composition, which shows the superior activity and an extraordinary high durability in comparison with commercial ones.

About the Speaker

Prof. Watanabe graduated the master course of Yamanashi University in 1968 and received his PhD degree in Physical Chemistry from the University of Tokyo in 1976. He has been a Professor of University of Yamanashi since 1989 and was the Director of Clean Energy Research Center (2001-2009) and has been the Director of Fuel Cell Nanomaterials Center (from 2008 until now). He has contributed to the advancement of the basic research on fuel cell materials for more than 40 years. His achievements include bimetallic alloy catalysts, based on precious metals such as Pt, with enhanced catalytic activity for various type fuel cells, robust hydrocarbon electrolyte membranes, high performance hydrogen production and purification catalysts. All of his works are deemed most important and essential subjects for the commercialization of fuel cells such as PEFC, DMFC, PAFC or SOFC, on which more than 270 original papers have been published in highly reputed international journals. Citation of papers of his research group in the international journals is beyond 11000 times totally and more than 1400 times every year in the recent years. He has been awarded many prizes to these works, e.g., MEXT Minister Award, ECSJ Award, Gold Medal of the International Society of Electrochemistry etc. He has promoted 6 national projects on fuel cells as the leaders since 1995. Currently he is managing one of the biggest national projects for PEFC material research, « HiPer-FC Project for 7 years».

Host: Professor Naotoshi NAKASHIMA

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