第281回触媒化学研究センターコロキウム（談話会）

共催　北海道大学グローバルCOEプログラム「触媒が先導する物質科学イノベーション」

Design and Synthesis of Bimetallic Nanocrystals for Catalytic Applications

Professor Younan Xia (Department of Biomedical Engineering, Washington University, St. Louis, USA)

September 24, 2010 (Fri) 13:30—14:30

Seminar Room BC, Sousei Hall, Hokkaido University

（北海道大学創成科学研究棟4階セミナー室BC）

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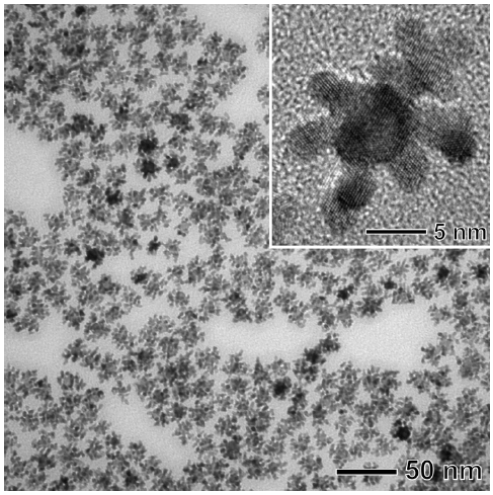

Despite the noteworthy progress in fuel cell technology, a number of key issues remain to be addressed. Among them, development of a more efficient and cost-effective catalyst having superior activity and stability for oxygen reduction, the rate-determining step in low-temperature fuel cells, has been identified as the most imperative challenge. One way to solve this problem is to replace the conventional Pt/C or Pt black catalysts with a Pt-based, bimetallic system. Recently, we have designed and synthesized such a system (see the Figure for typical SEM and TEM images) by growing dendritic Pt arms with large surface areas and highly active facets on nanocrystals of another metal such as Pd with controlled sizes and shapes. As compared to the currently existing catalysts, this novel bimetallic system offers at least four major attractive features: *i*) the electrocatalytic activity can be greatly enhanced by controlling the facets exposed on the Pt branches and/or the electronic coupling between the two metals; *ii*) the stability can be drastically improved by maneuvering the overall morphology of the bimetallic nanocrystals to avoid sintering and ripening problems; *iii*) the entire surface can be made highly accessible by taking a dendritic, open morphology; and *iv*) the loading of Pt can be reduced due to the use of a different metal in the core. Even without optimization in terms of composition and morphology, this novel Pd-Pt bimetallic catalyst was shown to exhibit mass-specific catalytic activity of almost three times greater than the state-of-the-art commercial Pt/C electrocatalysts, as well as enhanced stability. In this talk, I will discuss the new synthetic strategies with Pd and Pt as examples, and their potential extensions to different metal systems.

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281st Catalysis Research Center (CRC) Colloquium

Hokkaido University Global COE Program "Catalysis as the Basis for the Innovation in Materials Science"