# 第276回触媒化学研究センター談話会

Title: Structural, Electronic, and Catalytic Properties of Micellar Metal Nanoparticles: Size, Shape, Support, and Oxidation State Effects

Speaker：Dr. Beatriz Roldán Cuenya
Associate Professor, Department of Physics, University of Central Florida

Date&Time: 15:00-16:30, Fri, July 9, 2010
Place：Catalysis Research Center 4F Seminar Room（B・04-214/ C・04-213）

**＊本講演は英語で行なわれます。This lecture will be given in English.**

**Abstract**：The next generation of nanocatalysts requires detailed knowledge of the correlation between their structure (size and shape), chemical composition, and reactivity. To study these effects, large quantities of homogeneous and size-selected nanoparticles (NPs) are needed. We have synthesized size- and shape-selected Au, AuFe, Pt, and Pt-M (M = Au, Fe, Ru and Pd) NPs with well-defined interparticle distances by means of diblock copolymer encapsulation. Our synthesis method leads to 3D NP shapes even for sub-nanometer clusters, in contrast to the raft-like structures obtained for the same systems via traditional deposition-precipitation methods. It will be illustrated that the influence of NP/support interactions on NP structure can be diminished in favor of NP/adsorbate interactions when NP catalysts are prepared by micelle encapsulation methods. CO oxidation and alcohol decomposition and oxidation (methanol, ethanol and propanol) have been used as probe reactions. Emphasis is being given to investigating the role of the nanoparticle pre-treatment, support, and the oxidation state of the active catalytic species in their reactivity.

The well defined shape and thermal stability of our nanoparticles have enabled a series of detailed experiments. Using scanning tunneling spectroscopy, we have observed significant changes in the electronic local density of states of TiC-supported Au NPs, in particular, the onset of non-metallic behavior with decreasing particle size. In addition, temperature-programmed desorption measurements revealed a size-dependent reactivity for low temperature CO oxidation.

A dramatically enhanced thermal stability against coarsening and/or desorption of our self-assembled Pt NPs deposited on $TiO_2$(110) will be demonstrated. NP/support interactions in these novel micellar NP systems can be utilized to pattern catalytic oxide surfaces at the nanoscale. Following our synthesis approach, $TiO_2$ nanostripes with tunable width, orientation, and uniform arrangement over large surface areas were produced.

Oxidized Au and Pt species have been suggested to be responsible for the enhanced chemical activity of Au and Pt clusters. I will discuss how the NP size, support, cluster composition, and sample pre-treatment affect the stability of these species. Finally, a comparison of the reactivity of metallic versus oxidized species will be presented.Website: http://physics.ucf.edu/~roldan/

《連絡先》触媒化学研究センター　物質変換化学研究部門
福岡　淳（TEL: 011-706-9140）

主催：触媒化学研究センター
共催：グローバルCOE物質科学イノベーション