Chairman-Elect
Marco Castaldi
Past Chairman
Ruma Ghosh
Catalysis Society Representative
Israel Wachs
Directors
David Harris
Dave Calabro
John Byrne

The CATALYSIS SOCIETY of Metropolitan New York
www.nycsweb.org

Chairman
Wolfgang Ruettinger
(732) 205-5600
(732) 205-5300 (fax)
Wolfgang.Ruettinger@BASF.com

Secretary
JEFF YANG
732-205-6080
732-635-9478 (fax)
Jeff.Yang@BASF.com

Treasurer
JOHN BRODY
(908) 730-2932
(262) 313-4051 (FAX)
John.f.brody@exxonmobil.com

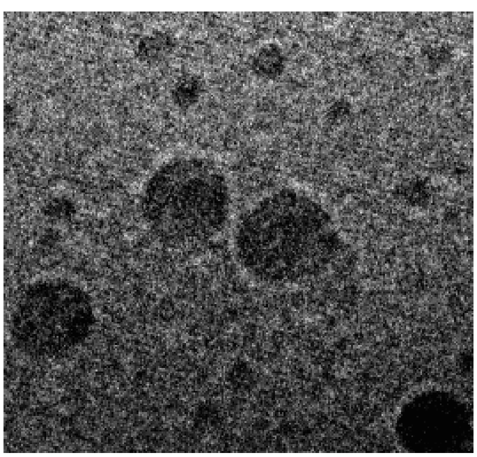
Wednesday, September 30, 2009
Crowne Plaza Hotel, Somerset, New Jersey
(Formerly Somerset Marriott)

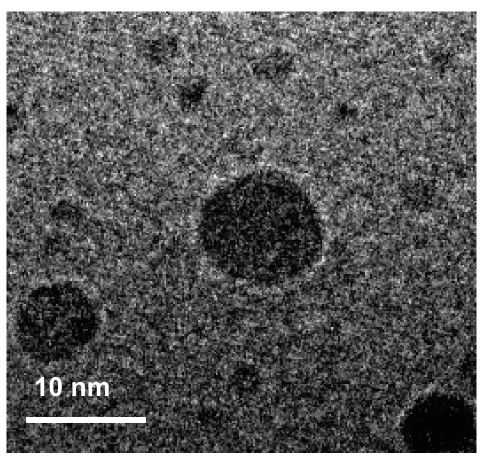
Improving The Stability Of Nanoparticles On Surfaces

Abhaya Datye
University of New Mexico

Size matters! Properties change significantly when we get to the nanoscale. In heterogeneous catalysts, this means selectivity and activity can change dramatically as particles become smaller. More important, small particles have high surface area, which can often translate to higher reactivity. Industrial catalysts are therefore composed of nanoparticles, at least when they are first made. But the higher fugacity of the nanoparticles leads to particle growth, via processes such as ripening and coalescence. The growth in particle size has major economic consequences, since additional precious metal needs to be added to compensate for the loss of activity.

Understanding sintering in industrial catalysts is difficult since several phenomena occur in parallel. For example, the catalyst support may change, collapse or encapsulate the active phase. Our studies include high surface area industrial catalysts and also model catalysts, where nanoparticles are supported on flat oxide surfaces. We have performed in-situ observations for unraveling the atomic scale details of catalyst sintering, and have used Monte Carlo simulations to understand the experimental observations. The two still images below come from in-situ TEM observations at elevated temperatures and show two large particles undergoing coalescence, while the other smaller particles remain immobile. This flies in the face of conventional wisdom where all catalyst sintering is thought to be driven by Ostwald ripening. This talk will present a summary of the progress we have made towards understanding catalyst sintering with the goal of designing catalysts which are stable and retain their performance over the long term.





Before

After

A coalescence event captured during in-situ TEM of a $Ni/MgAl_2O_4$ catalyst during observation at 700 °C in 10 mbar of H_2/H_2O