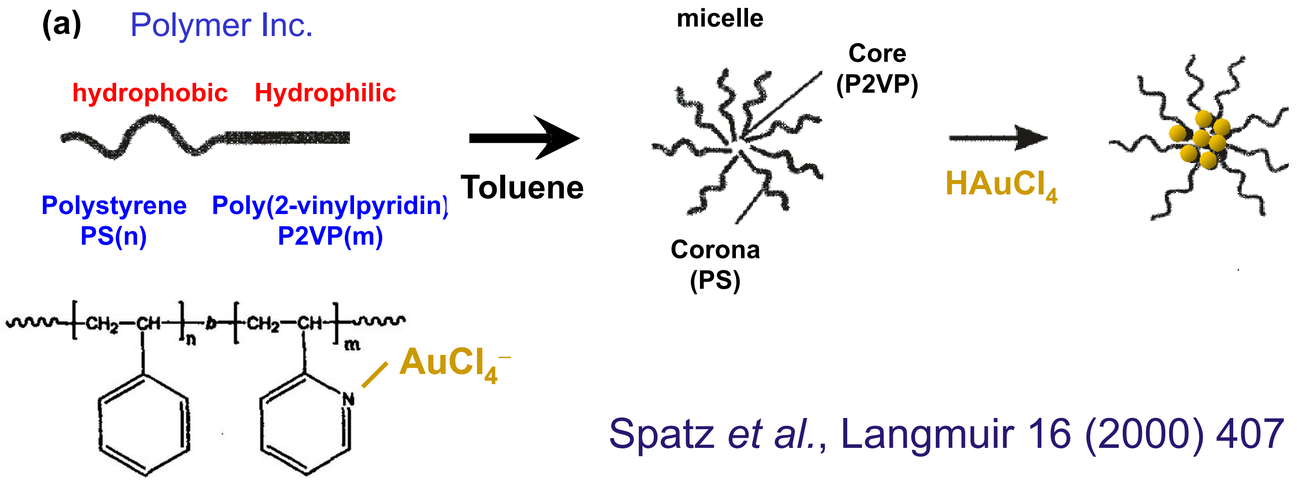
In-situ gas phase catalytic properties of size selected gold nanoparticles

Luis K. Ono, Beatriz Roldan Cuenya

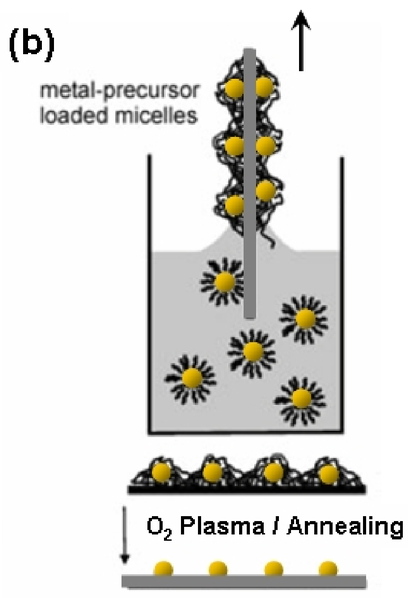
Department of Physics, University of Central Florida, FL 32816

1. Nanoparticle Synthesis/Characterization

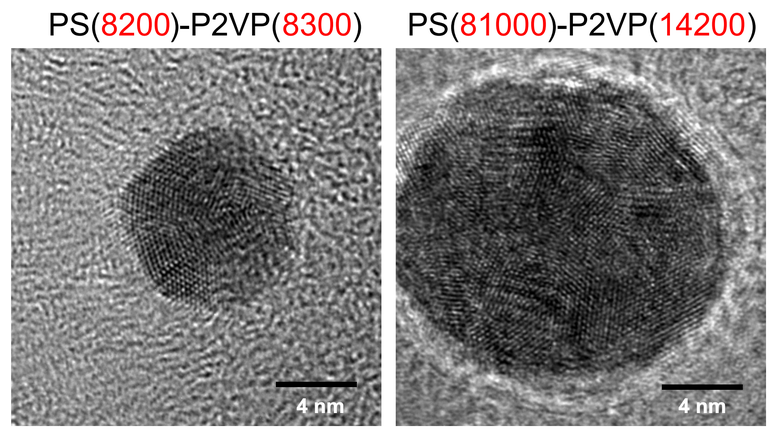
Micelle Encapsulation : Truncated Spheroids



Spatz *et al.*, Langmuir 16 (2000) 407



TEM :

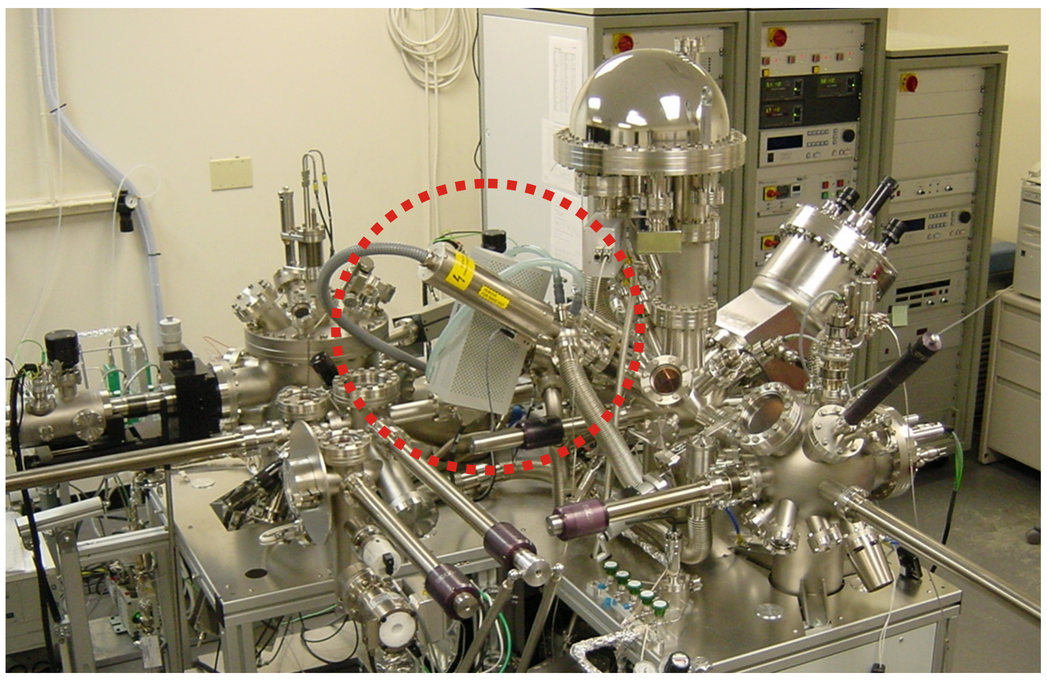


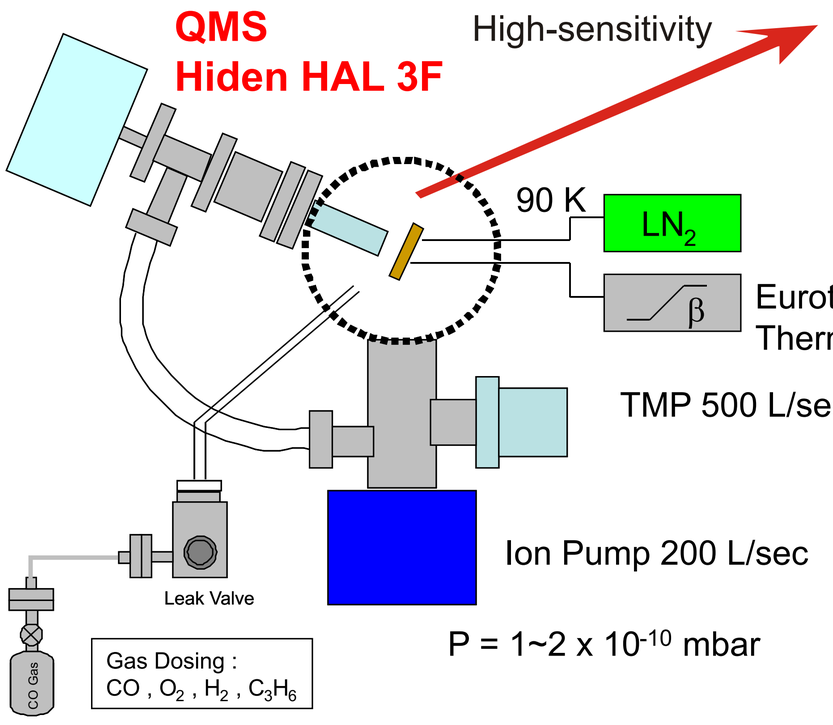
Polycrystalline
Multifaceted fcc-Au

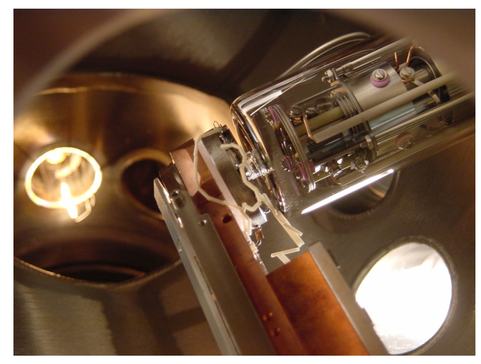
Roldan Cuenya *et al.*, JACS. **125** (2003) 12928, JACS Comm. **125** (2003) 7148

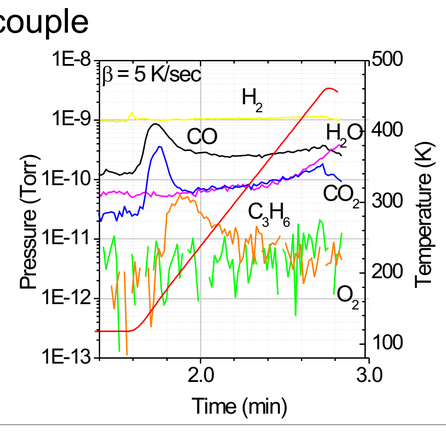
2. *In-situ* Chemical Characterization Setup

UHV temperature programmed desorption (TPD) system



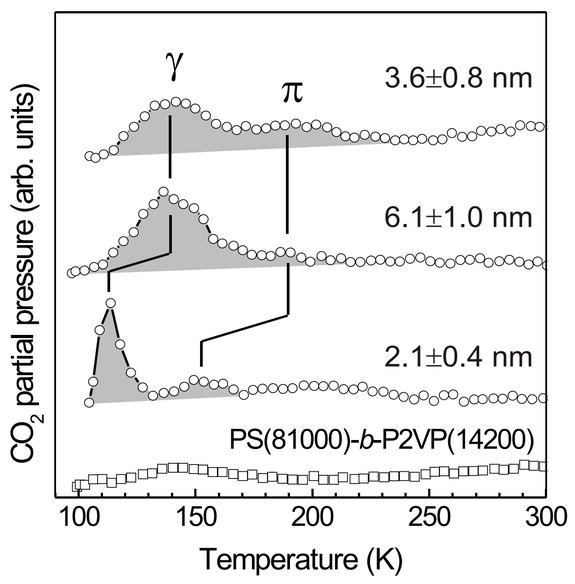


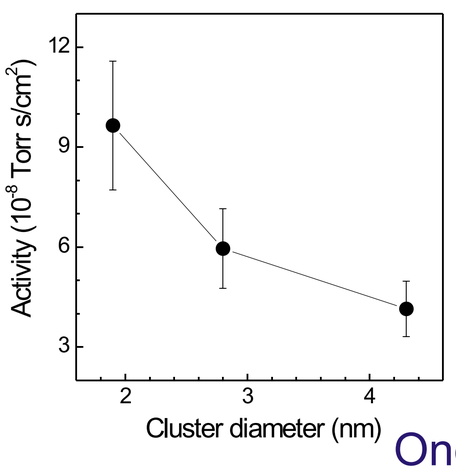




3. Size dependent reactivity

$CO + ½ O_2 \rightarrow CO_2$ Au/TiC





CO [0.6 L] + O_2 [0.3 L]

1. TiC inactive.

2. Two desorption sites :
   γ : steps/kinks
   π : Au-TiC interface

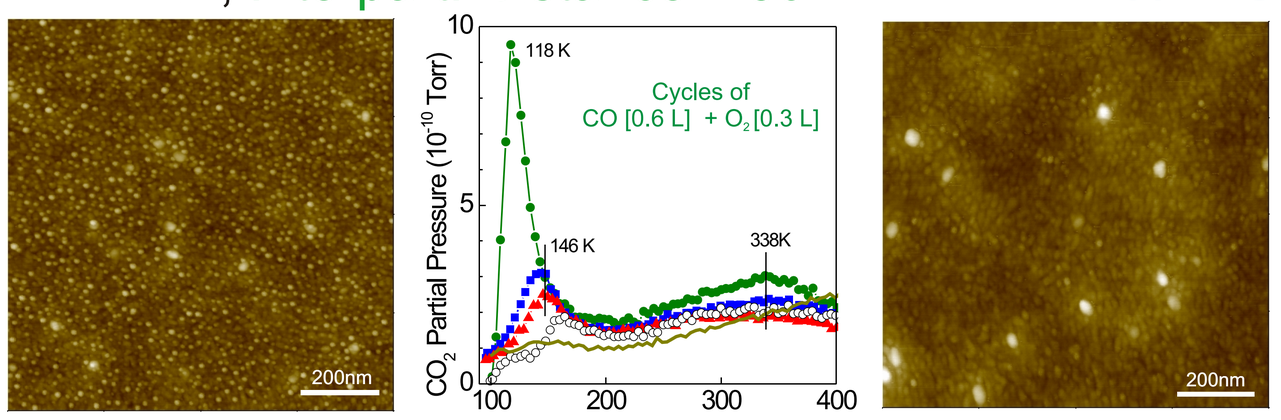
3. RelativeContribution :
   A[γ] / A[π] ~ 3

4. Highest activity for smallest nanoparticles (2.1 nm).

Ono *et al.*, Surf. Sci. 600 (2006) 5041

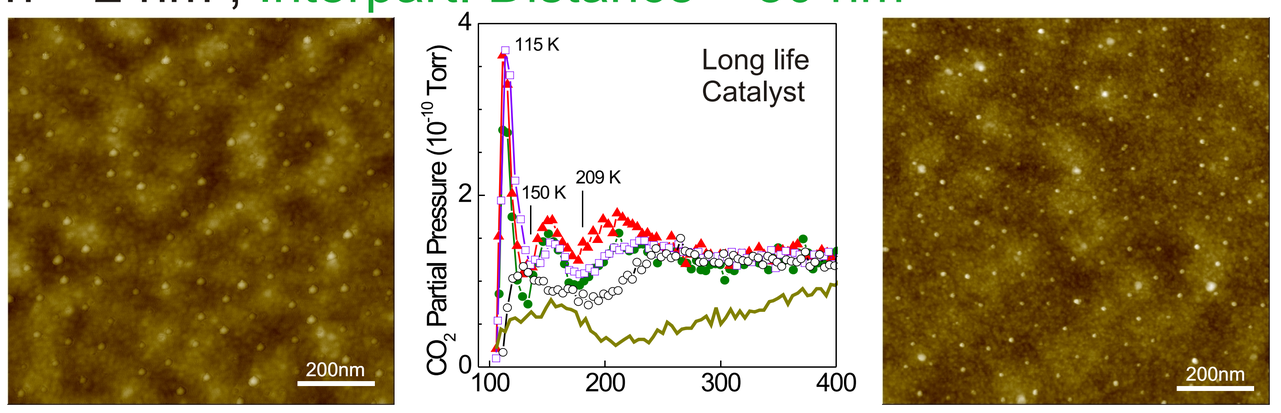
4. Influence of interparticle distance

h ≈ 2 nm ; Interpart. Distance ≈ 30 nm Au/TiC



Deactivation after 1st TPD.
Reactive coarsening.

h ≈ 2 nm ; Interpart. Distance ≈ 80 nm



No deactivation after 17 TPD cycles.

Ono *et al.*, Catal. Lett. 113 (2007) 86

5. Conclusions

- Au nanoparticles/TiC ⇒ active for low-T CO oxidation.
- Size-dependent reactivity ⇒ Highest activity for ~2 nm Au particles.
- Catalysts lifetime depends on initial interparticle distance.

Funding :

NSF CAREER

ACS PRF