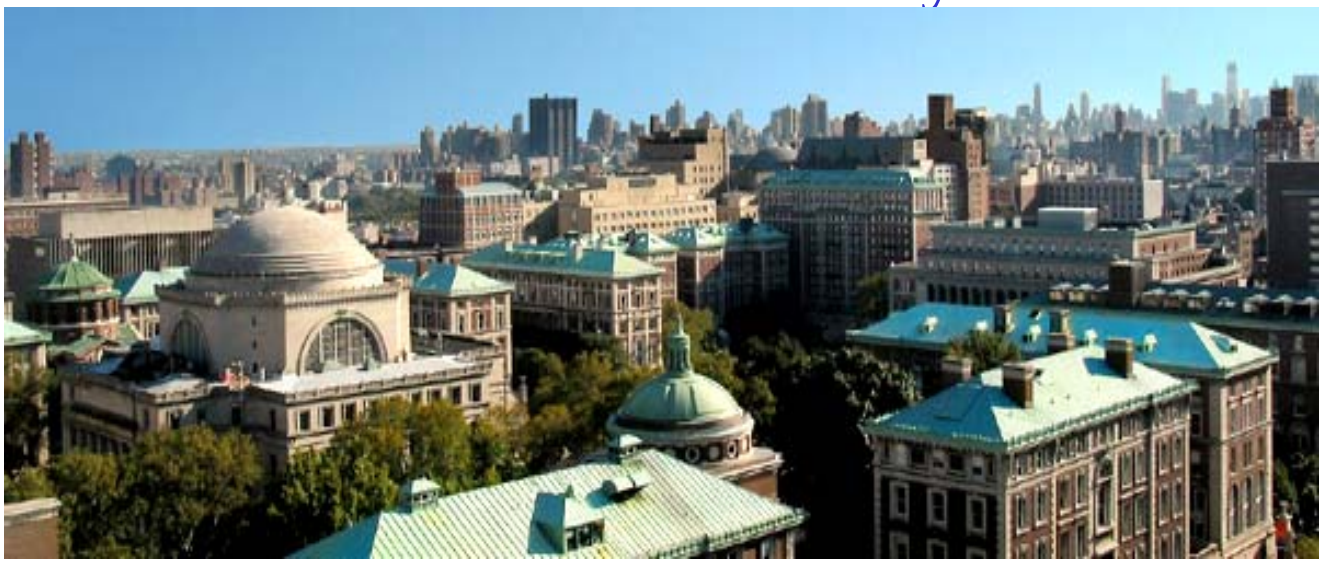
# Oxide Nanoparticles: Phase Stability, Defect Concentration, Redox Behavior & activities as catalyst support

Siu-Wai Chan 陳小惠

Dept. of Appl. Phys. & Appl. Math.
Columbia University



NSF PI Workshop September 9, 2010

# Structure of Oxide Nanoparticles

- Phase Stability
  - **crystallite-size**
  - **redox environment, $Po_2$**
  - **ion-size, composition**
  - **strain induced reduction**
- Redox Processes
  - **crystallite-size effect**
  - **intermediate phase**
  - **Specific surface redox w/metal modification e.g. STM Au- $Fe_3O_4$**
- Lattice Parameter (**$CeO_2$**, $Cu_2O$, MnO)
  - **crystallite-size**
  - **surfactant**
  - **pressure (B)**

**Binary**

**$ZrO_2$ - $CeO_2$**

**$HfO_2$ - $CeO_2$, $HfO_2$ - $ZrO_2$**

**Mono**

**$CeO_{2-x}$, $HfO_2$ , $ZrO_{2-x}$**

**CuO, $Cu_2O$, ZnO, $Mn_3O_4$ , $Mn_2O_3$ , MnO, $Co_3O_4$, $Fe_3O_4$**

**Metal modified**

**Au, Pd, Cu on $CeO_{2-x}$, ZnO , $ZrO_{2-x}$, $Fe_3O_4$**

- Multivalent
- Catalysts-reforming, environment TWC.
- CMP, Gate oxides,
- Fuel Cells, $H_2$-generation

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK