Investigating the Role of Ceria on Trapping Platinum

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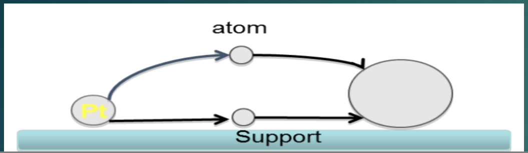
Problem:

Atomically dispersed platinum on a ceria support structure is promising for a diesel oxidation catalyst used to convert toxic car emissions to nontoxic gases. However, platinum forms large particles due to Ostwald Ripening at high temperatures, decreasing exposed Pt surface area and therefore catalytic activity.

Goal:

Determine the role of ceria in trapping Pt by determining the surface concentration of Pt atoms on high surface area (HSA) ceria, ceria rods, ceria cubes and ceria octahedra.

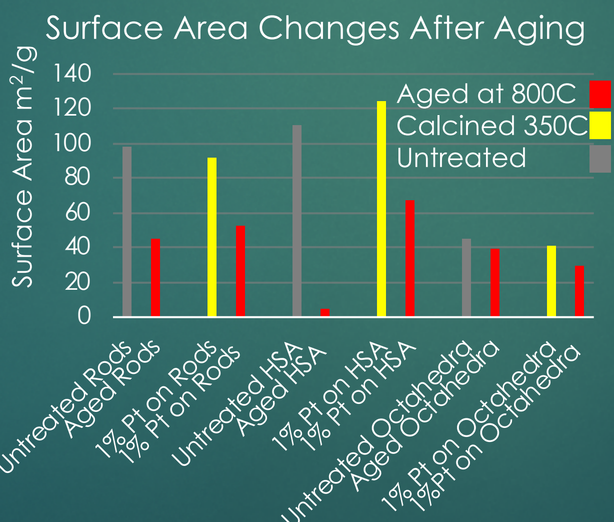


Ostwald Ripening; Jones MS Thesis

Results:

Ceria Structure	Pt Surface Concentration (atoms/nm²)
HSA 350°C	0.3
HSA 800°C	0.4
Octahedra 350°C	0.5
Octahedra 800°C	0.8
Rods 350°C	0.3
Rods 800°C	0.7

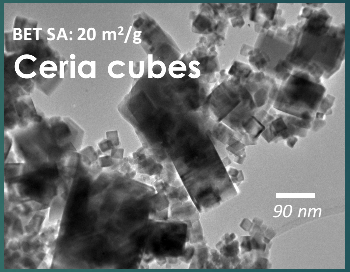
Surface concentration of Pt determined using EDS weight percent and BET surface area

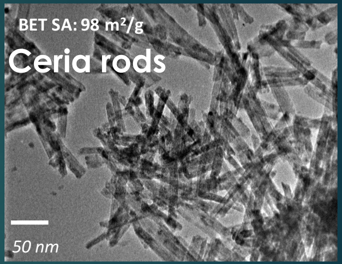


Pt slows the surface area drop of HSA and rods, but not octahedra. This is because untreated octahedra are already stable due to low energy (111) facet.

Methods:

- **Ceria nanorods and nanocubes were synthesized using a hydrothermal treatement (*Mai, J. Phys Chem, 2005*).**





- **1 weight percent Pt on ceria catalysts were prepared using incipient wetness for HSA ceria, rods, and octahedra with chloroplatinic acid as a precursor.**
- **The catalysts were calcined in air at 350°C for 2 hours and then aged at 800°C for 8 hours.**
- **Surface areas of catalysts were determined using BET and weight% was determined by energy dispersive spectroscopy**

Future Steps

- **Determine the saturation limit of Pt by making catalysts saturated with Pt so that large particles form.**
- **Use X-ray diffraction to determine the crystalline Pt present, and use energy probe microanalysis to determine the amount of dispersed Pt.**
- **If the two weight percents add up to the nominal weight loading, the weight percent by EPMA is the Pt saturation limit.**