Synthesis of nano-meter sized Core/Shell Bimetallic Clusters and their Hydrogen Uptake Capacity

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The main purposes of this work are size selective synthesis bimetallic core-shell clusters, such as Mg-Pd cluster with size range (2-10 nm), by using salt reduction-electrochemical combine technique, and investigating the effect of varying the preparation parameters, into the size and structure of the prepared bimetallic clusters, and investigating the hydrogen uptake capacity of these bimetallic nanoparticles.

In the proposed project the hydrogen solubility in different metallic clusters with discrete sizes should be investigated. Ideal candidates to be researched are surfactant stabilized clusters, which are tension-free stabilized and have a narrow size distribution. In this project the clusters will be Bimetallic (Mg/Pd) core/shell clusters.

In this work the preparation of bimetallic core/shell nano-particles will be performed by using salt reduction-electrochemically combined technique. This method is simple and cheap, other advantages of this method is that nano-particle size can be easily controlled by varying the preparation's parameters, such as Temperature, distance between the electrodes, electrolysis current, and solvents. That means (size selective method).

These bimetallic clusters are expected to have a good solubility and capacity to storage hydrogen, and a high stability too. Because both of magnesium and palladium metals have a very high ability to uptake hydrogen atoms and forming hydrated metals. Whereas magnesium is unstable metal-hydrides formation (has a high enthalpy of formation (MgH_2) thus it is stabilized with alloyed by other stable transition metals as Ni or Al, or by formation of bimetallic clusters with one metal be used to enhance the kinetics of hydrogen absorption by reducing the large activation barrier that magnesium inherently possesses that is palladium metal.

Then we will study the influence effecting on the hydrogen storage in these bimetallic clusters and how we can be able to promoting the adsorption/desorption processes with changing the size or M-M ratio into core-shell bimetallic clusters.

In this work the hydrogen uptake capacity in nano-meterd sized bimetallic clusters with different sized and different structure will be determined isothermally from volumetric solubility measurements.