Metallothermic Reduction: Reaction Mechanisms to Functional Nanomaterials

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Metallothermic reduction allows for the synthesis of metallic and alloyed nanomaterials by reduction of their oxides or halides with a more electropositive element. In general, the metal of choice should be cheap, produce a desirable byproduct, and be easy to handle, among other factors. Metallothermic reduction has become a popular route to prepare nano- and micro-materials for batteries, capacitors, catalysts, and gas storage. Applications in energy storage and catalysis requires precise control over the pore size, surface area, and structural integrity of the nano- and micro-materials used.

Elements such as Mg, Al, C, Zn, and Ca are routinely used to synthesize porous silicon, germanium, tin, and various metal carbide and nitrides. However, to date no systematic investigation has been done to study the influence of reducing metals on the formation of desired products. This presentation will highlight how various metals affect the physical properties (surface area, morphology, pore size distribution, etc.) and structural integrity of the products prepared via metallothermic reduction. Further, new synthetic metallothermic routes to prepare funtional nanomaterials will also be discussed.

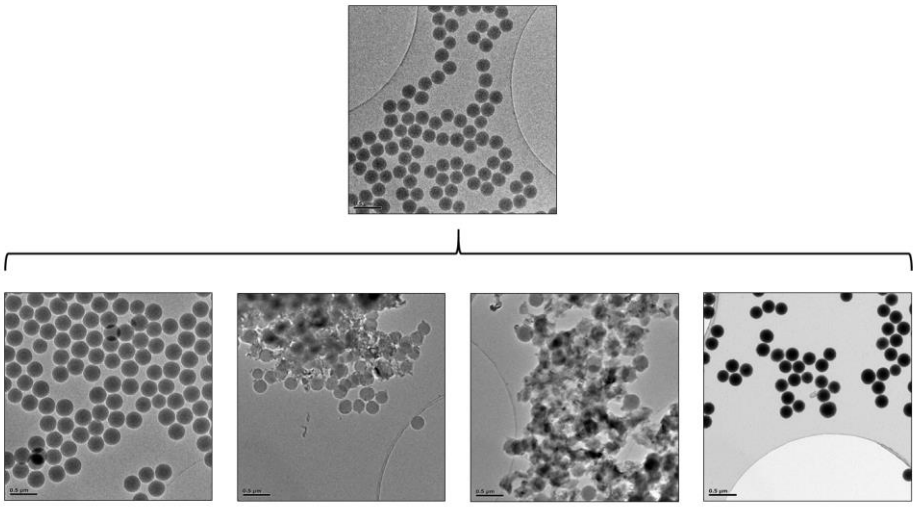

Fig. 1 Transmission Electron Micrographs of Stöber silica nanoparticles (top) and reduced products (bottom) obtained using various different metals.