

Novel Routes to the Synthesis and Functionalization of Metallic and Semiconductor Thin Film and Nanoparticles

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Abstract : The process of assembling metal nanoparticles at the interface of two liquids has received a great deal of attention over the past few years due to a wide range of important applications and their unusual properties as compared to bulk materials. We present a low cost, simple and cheap synthesis of metal nanoparticles, core/shell structures and semiconductors followed by assembly of these particles between immiscible liquids. The aim of this talk is divided to three parts: Firstly, to describe the achievement of a closed loop recycling for producing cadmium sulfide as powders and/or nanostructured thin films for solar cells or other optoelectronic devices applications by using a different chain length of commercially available secondary amines of dithiocarbamate complexes. The approach can be extended to other metal sulfides such as those of Zn, Pb, Cu, or Fe and many transition metals and oxides. Secondly, to synthesis significantly cheaper magnetic particles suited for the mass market. Ni/NiO nanoparticles with ferromagnetic properties at room temperature were among the smallest and strongest magnets (5 nm) were made in solution. The applications of this work can be to produce viable storage devices and the other possibility is to disperse these nanocrystals in solution and use it to make ferrofluids which have a number of mature applications. The third part is about preparing and assembling of submicron silver, cobalt and nickel particles by using polyol methods and liquid/liquid interface, respectively. Coinage metals like gold, copper and silver are suitable for plasmonic thin film solar cells because of their low resistivity and strong interactions with visible light waves. Silver is the best choice for solar cell application since it has low absorption losses and high radiative efficiency compared to gold and copper. Assembled cobalt and nickel as films are promising for spintronic, magnetic and magneto-electronic and biomedics.

Keywords : metal nanoparticles, core/shell structures and semiconductors, ferromagnetic properties, closed loop recycling, liquid/liquid interface

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