COMPOSITE NANOMATERIAL WITH ENHANCED MAGNETIC AND/OR OPTICAL PROPERTIES

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Nanocomposite materials containing a magnetic phase and another functional phase have been attracting much interest from materials scientist because of the many interesting and important scientific and technological aspects. Especially, iron-gold core-shell nanoparticles are the most interesting nanocomposite materials due to the potential advantages of magnetic separation from precursor materials and the possibility of facile surface modification by well known gold/thiol chemistry.

The primary objective of our research efforts is to develop anisotropic core-shell nanostructures such as Fe_3O_4-Au, Fe_3O_4-Pd. In the present study, we will report on the synthesis of cube shaped core-shell iron-gold nanoparticles. Characterization of the magnetic nanocubes showed that the synthesized nanocubes composed of iron core- gold shell. Rapid, easy and room temperature synthesis of magnetic gold nanocubes and subsequent modification of gold shell with thiol chemistry provide binding of different biomolecules for sensing application. Moreover, SERS effect of gold shells allows us monitoring the binding of biomolecules without any labeling.

The second part concerns the combination of these nanoparticles to conducting polymers. For this purpose, nanostructured polyaniline was prepared by simple interfacial polymerization using immiscible organic/aqueous biphasic systems in the presence of sulfonated β-cyclodextrin and sulfonated α-cyclodextrin. Sulfonated β-cyclodextrin and sulfonated α-cyclodextrin were used to play both the role of surfactant and dopant. Uniform polyaniline nanofiber with average diameter of 50-60 nm was obtained in the presence of sulfonated cyclodextrin in polymerization media and using $FeCl_3$ as an oxidant. The molecular structures of the nanostructured polyaniline were characterized by SEM, FTIR, UV-Vis, EDAX and ESCA measurements.