Magnetic Nanoparticles for Biological Applications

Mr. Hitesh Bagaria
Department of Chemical and Biological Engineering
University of Alabama

Abstract

Magnetic nanoparticles can find a number of interesting biological applications such as biosensors, magnetic resonance imaging, drug delivery, and magnetic fluid hyperthermia owing to: their size, which allows them to be able to interact with biological entities; their magnetophoretic ability in an applied magnetic field; and their ability to transfer energy from an alternating magnetic field.

Our interest lies primarily in their ability to transfer energy from an alternating magnetic field into heat. The emerging cancer therapy named Magnetic Fluid Hyperthermia is based on this attribute of magnetic nanoparticles. In addition another important property that they should possess is the ability to bind to biological entities like proteins or DNA. Such binding capability can be introduced by providing appropriate ligands on the surface of the nanoparticle.

We have been studying the preparation of FePt and NiPd binary alloy nanoparticles. FePt is an interesting system owing to its very high saturation magnetization along with the better corrosion resistance as compared to pure iron. NiPd is interesting due to its low Curie temperature. The Curie temperature of NiPd nanoparticles can be tuned by varying its composition. By providing NiPd nanoparticles with a Curie temperature that is equal to the therapeutic temperature for hyperthermia, self-regulated heating can be achieved.

This presentation concerns the preparation and characterization of FePt and NiPd nanoparticles, and the ligand exchange carried out on the surface of FePt nanoparticles.