SYNTHESIS AND CHARACTERIZATION OF POLYMER-EMBEDDED $CoPt_3$ NANOPARTICLES FOR BIOANALYTICAL APPLICATIONS

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The recent developments in the synthesis and characterization of nanomaterials afforded new means to produce functional nanoparticles, at a size scale comparable to those of important biological systems. These functional nanostructures are expected to have a great impact in medicine. For example, there has been great interest in magnetic nanoparticles for biomedical applications which include magnetic cell separation and labelling, drug targeting, hyperthermia treatments and magnetic resonance imaging agents [1].

For biological applications however, the use of magnetic nanoparticles produced by colloidal routes is limited by their lack of biocompatibility. To overcome this drawback, different surface modification strategies have been developed. The most popular is the encapsulation of magnetic nanoparticles in a protective shell, which can be inorganic (e.g. silica) [2] or organic (e.g. polymer) [3]. The protective shell also enables further surface modifications and protects from particle aggregation and nonspecific binding to the cells. Polymer based magnetic nanoparticles seemed especially versatile materials since they can be tailor to fulfill the requisites of biocompatibility and biofunctionality, necessary for medical applications [4].

We have been interested in investigating strategies to develop colloidal systems for bioanalytical applications, including the magnetic separation of cells. Our previous studies showed that hydrophobic inorganic nanoparticles can be embedded in polymer matrices using the miniemulsion polymerization technique [5]. This led us now to investigate in more detail the preparation of organically capped magnetic nanoparticles (e.g. $CoPt_3$).

Here we present our results concerning magnetic functionalized latexes prepared by the encapsulation of organically capped $CoPt_3$ magnetic nanoparticles via *in situ* radical miniemulsion polymerization of *tert*-butyl acrylate (*t*BA) (Figure 1-1). The magnetic $CoPt_3$/P(*t*BA) nanocomposites contain surface protected polyester groups that can be readily removed by hydrolysis, rendering the surface with carboxylic functionalities to improve aqueous stability and to promote bioconjugation. As a proof of concept, the bioconjugation of antibodies to the nanoparticles surfaces have been demonstrated (Figure 1-2) and the application of this strategy to other bio-functional nanomaterials will be discussed.

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Figure

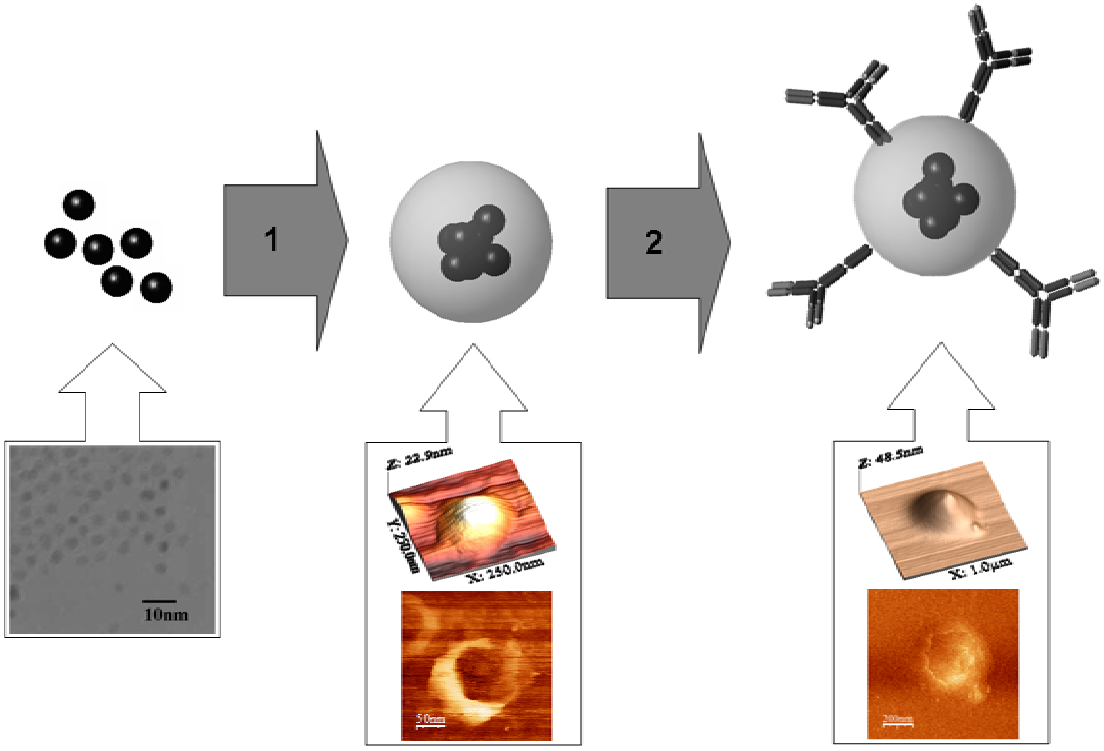

Figure 1. Surface modification of magnetic nanoparticles and antibody conjugation: 1) the organically capped $CoPt_3$ nanoparticles were encapsulated into P*t*BA; 2) the surface polyester groups of P*t*BA were removed by hydrolysis to produce surface carboxylic groups which were used to anchor antibodies. (a) TEM image of organically capped $CoPt_3$ nanoparticles (b) AFM images of the $CoPt_3$/P*t*BA nanocomposite (topography and phase modes) (c) AFM images of an antibody attached to the surface of a $CoPt_3$/P*t*BA nanoparticle (topography and phase modes).

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