

## ULTRASOUND ENHANCED FERRITE PLATING FOR ENCAPSULATING MICROSPHERES

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Polyacrylate microspheres of 4.5  $\mu\text{m}$  in diameter were coated with a continuous magnetite layer by ultrasound enhanced ferrite plating, at 70°C from an aqueous solution of  $\text{FeCl}_2$ , utilizing  $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$  oxidation by  $\text{NaNO}_2$ . Power ultrasound waves (20 kHz, 750 W) were applied to the  $\text{FeCl}_2$  solution. The surfaces of the ferrite coatings were observed by a field emission type scanning electron microscope (FE-SEM) (Fig. 1). The initial nucleation islands of ferrite are 10-20 nm in size when plated for 20 sec (b). They grow in number and in size when plated for 2 min (c). Microspheres plated for 90 min in this study (d) are compared with those plated for 20 min (e) and for 90 min (f) without sonication. The ferrite coatings prepared in this study are  $\sim 100$  nm in grain size. Fig. 2 shows plating time dependence of saturation magnetization of the ferrite-coated microspheres and thickness of the ferrite coating. Experience has shown that magnetic separation using the 4.5  $\mu\text{m}$ -sized particles is best performed when the magnetite coating is  $\sim 50$  nm in average thickness, or magnetite occupies  $\sim 20\%$  in total weight fraction of the ferrite-coated particles[3]. Turbidity analyses revealed that these ferrite – encapsulated microspheres exhibit lower sedimentation rate and higher efficiency of magnetic separation than the previous ones. This will improve the performance of enzyme immunoassay, which has been put to practical use utilizing the partially-ferrite –coated microspheres

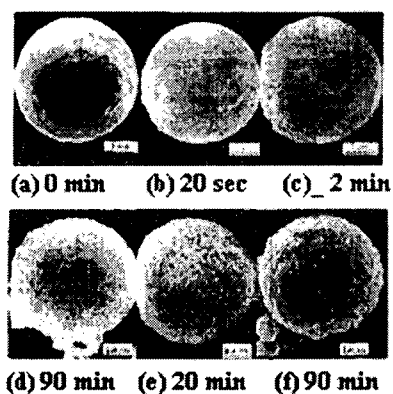


Fig.1. FE-SEM images of polyacrylate spheres ferrite-coated under sonication for 0-90 min (a-d). (e, f) is without sonication.

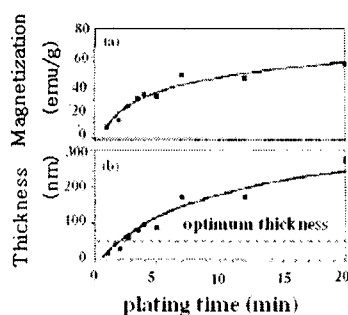


Fig.2. Saturation magnetization and calculated thickness of ferrite coating, plotted as a function of plating time. Optimum thickness for biomagnetic separation is indicated.

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