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Investigation of Optical, Film Formation and Magnetic Properties of PS Lates/MNPs Composites

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Abstract : In this study, optical, film formation, morphological and the magnetic properties of a nanocomposite system, composed of polystyrene (PS) latex polymer and core-shell magnetic nanoparticles (MNPs) is presented. Nine different mixtures were prepared by mixing of PS latex dispersion with different amount of MNPs in the range of (0- 100 wt%). PS/MNPs films were prepared from these mixtures on glass substrates by drop casting method. After drying at room temperature, each film sample was separately annealed at temperatures from 100 to 250 °C for 10 min. In order to monitor film formation process, the transmittance of these composites was measured after each annealing step as a function of MNPs content. Below a critical MNPs content (30 wt%), it was found that PS percolates into the MNPs hard phase and forms an interconnected network upon annealing. The transmission results showed above this critical value, PS latexes were no longer film forming at all temperatures. Besides, the PS/MNPs composite films also showed excellent magnetic properties. All composite films showed superparamagnetic behaviors. The saturation magnetisation (Ms) first increased up to 0.014 emu in the range of (0-50) wt% MNPs content and then decreased to 0.010 emu with increasing MNPs content. The highest value of Ms was approximately 0.020 emu and was obtained for the film filled with 85 wt% MNPs content. These results indicated that the optical, film formation and magnetic properties of PS/MNPs composite films can be readily tuned by varying loading content of MNPs nanoparticles.

Keywords : composite film, film formation, magnetic nanoparticles, ps latex, transmission
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