Hybrid nanocomposite films based on polystyrene-*block*-polymethyl methacrylate block copolymer and synthesized colloidal nanoparticles

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Abstract

The development of novel hybrid nanocomposites by means of the combination of block copolymers acting as matrices with nanometric materials is gaining increasing interest in the material science field. Block copolymers are ideal materials for this purpose as chemically different blocks are covalently linked with each other, giving them the ability to self-assemble into different ordered nanoscale morphologies. On the other hand, nanoscale materials, in particular nanoparticles, possess interesting properties, such as electrical, magnetic, mechanical or optical, among others. Thus, the combination between nanostructured block copolymers and nanoparticles will result in hybrid inorganic/organic materials with functional properties.

In the past decade, many researchers have used polystyrene-*block*-polymethyl methacrylate (PS-*b*-PMMA) block copolymer as a template to create hybrid inorganic/organic nanocomposites by adding different inorganic nanoparticles (NP) to the polymeric matrix [1-4]. In this case, both *ex-situ* synthesized titanium oxide nanorods and iron oxide nanocrystals have been incorporated into the PS-*b*-PMMA block copolymer [3,4]. The synthesis procedure carried out to obtain colloidal titanium oxide nanorods and iron oxide nanocrystals [5] led to oleic acid capped nanoparticles, which make them more compatible with one block of the block copolymer, the PS block in particular. The characterization of the nanoparticles was performed by transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FTIR) in order to analyze the size and shape of nanoparticles and to confirm the presence of surfactant on their surface. Thank to this capping layer, the content of nanoparticles in the block copolymer can achieve values up to 50-60 wt % in respect to the block copolymer content. NP/PS-*b*-PMMA nanocomposites were characterized in terms of their morphology by atomic force microscopy (AFM) and scanning force microscopy (SEM) and also their optical, electrical and magnetic properties were studied.

References

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Figures

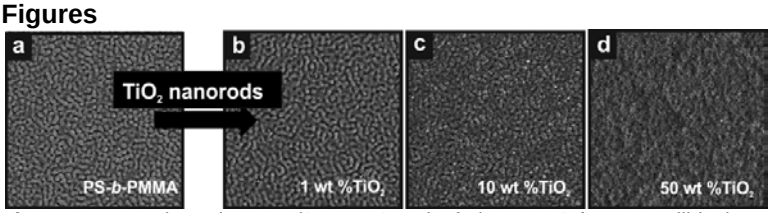

Figure 1. AFM phase images (2 µm x 2 µm) of a) neat PS-*b*-PMMA diblock copolymer and its nanocomposites with b) 1, c) 10 and d) 50 wt % synthesized TiO_2 nanorods.

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