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Preparation of polymer/graphene oxide nanocomposites by a two-step strategy composed of in situ polymerization and melt processing

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ABSTRACT: Pickering emulsion-templated polystyrene (PS)/graphene oxide (GO) composite microspheres were successfully prepared using surface-functionalized silica as the stabilizer. These preformed polymer/GO composite microspheres were then melt-blended into polymer matrix to prepare nanocomposite materials in a short minute using HAAKE torque rheometer. Transmission electron microscope (TEM) images of the nanocomposites demonstrate that GO is uniformly dispersed into PS matrix. A significant decrease of coefficient of thermal expansion (CTE) values from more than 150 to 50 ppm/K is realized with the introduction of well-dispersed GO nanosheets. The glass transition temperature (T_g) and the temperature of 5 % weight loss ($T_{0.05}$) are increased by 5 and 17 ^{o}C, respectively. Furthermore, the impact energy of the composite sample with a GO loading of 0.86 % is 64 % greater than that of pure PS, and is nearly twice as high as that of the composite which was prepared by direct melt-blending of surface-modified GO and commercial PS. The tensile strength and elongation at break of the composites are also obviously improved. The work provides an economic and convenient method which eliminates the dispersion problem of GO in polymer matrix to prepare GO-based nanocomposite materials for industrial application on a large scale.

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