7th International Conference on
Science and Development of Nanotechnology

Investigation of thermal stability of phenolic resin / graphene nanocomposite

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Abstract

Phenol formaldehyde resins or phenolic resins are synthetic polymers obtained by the reaction of phenol or substituted phenol with formaldehyde. Used as the basis for Bakelite, PFs were the first commercial synthetic resins. Graphene-based nanocomposites possess excellent mechanical, electrical, thermal, optical, and chemical properties. These materials have potential applications in high-performance transistors, biomedical systems, sensors, and solar cells. In this article by incorporating graphene oxide (GO) into phenolic resin (PR), GO/PR composites were prepared, and the effects of the content and reduction degree of GO on thermal resistance of GO/PR composites were studied. The peak degradation temperature of the PR was increased by about 14 °C with GO which was heat treated. The char yield of GO/PR composite at a GO weight fraction of 0.5% was about 11% greater than that of PR. The interactions such as covalent bonds and π- π stacking between GO and PR were regarded as the main reason for the enhancement. Located at the GO-PR interface, GO effectively anchored and structured PR molecular near the surfaces of GO sheets, and thus facilitated the formation of char. The superiority of GO/PR composites over PR in terms of thermal properties enhancement should also be related to the promoting graphitization by the addition of GO.

Keywords: Polymer–matrix composites (PMCs), Thermal properties, Thermal analysis, Thermosetting resin.