

**THE MECHANICAL PROPERTIES OF GRAPHENE REINFORCED
POLYSTYRENE**

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ABSTRACT

Industrial needs and technological advancement drives the demand for lighter materials, resistant and is durable, has flexibility with viable cost. Thus arose polymeric composites with different types of use and application to know; aeronautics, aerospace, automobile and sporting goods. Development of polymer nanocomposite is an interesting area in advanced material research because of its capability of providing improved mechanical, thermal and electrical properties. In comparison to other materials the potential use of graphene based nanocomposites has attracted wide attention both for fundamental aspects as well as applications. The challenges for development high performance graphene polystyrene nanocomposites are to ensure good quality dispersion of graphene in the polymer matrix. This paper presents mechanical properties studies of graphene and polystyrene nanocomposite. Different compositions of graphene and polystyrene mixture were manufactured by using melt blending technique. The mechanical properties of GPS nanocomposites were studied through tensile, flexural and impact tests. X-ray diffraction (XRD) was employed to characterize the formation of nanocomposites. Moderate improvement of impact energy was found up to 22% which proved that GPS nanocomposites were successfully toughened by graphene. Addition of graphene to polystyrene also increases the tensile strength significantly. Moreover, the modulus strength also had increases with additional of graphene. The result express of stiffness and strength of the material. Reduction of flexural modulus demonstrated modifier was better in maintaining the stiffness while enhancing the toughness of PS. XRD established that Graphene were well dispersed and preferentially embedded in the PS phase. Formulation of 98.5:1.5 polystyrene to graphene ratio was shown the balance portion between stiffness and toughness of the GPS nanocomposite. The GPS nanocomposite is believed to offer possibilities can be used in automotive and furniture applications.

ABSTRAK

Keperluan industri dan kemajuan teknologi mendorong permintaan untuk bahan-bahan yang ringan, tahan lama, mempunyai fleksibiliti dengan kos yang berpatutan. Oleh itu timbul komposit polimer dengan pelbagai jenis kegunaan dan aplikasi seperti aeronautik, aeroangkasa, kereta dan barangan sukan. Pembangunan polimer Komposit nano adalah menarik dalam bidang penyelidikan bahan termaju kerana keupayaan untuk menyediakan sifat mekanik, haba dan elektrik yang baik. Berbanding dengan bahan-bahan lain, potensi penggunaan nanokomposit berasaskan graphene telah menarik perhatian kedua-dua aspek asas serta aplikasi. Cabaran untuk pembangunan berprestasi tinggi nanocomposites graphene polistirena adalah untuk memastikan penyebaran kualiti yang baik daripada graphene dalam matriks polimer. Kertas kerja ini membentangkan ciri-ciri kajian mekanik graphene dan polistirena Komposit nano. Komposisi yang berbeza daripada graphene dan polistirena campuran telah dihasilkan dengan menggunakan teknik mencairkan campuran. Sifat-sifat mekanik komposisi nano GPS dikaji melalui ujian tegangan, lenturan dan kesan. X-ray pembelauan (XRD) telah digunakan untuk mencirikan pembentukan nanocomposites. Peningkatan sederhana tenaga kesan didapati sehingga 22% yang membuktikan bahawa GPS komposisi nano telah berjaya dikuatkan oleh graphene. Penambahan graphene untuk polistirena juga meningkatkan kekuatan tegangan dengan ketara. Hasil daripada ujikaji menyatakan kekerasan dan kekuatan bahan ini dapat dibuktikan. Pengurangan lenturan modulus pengubahsuai menunjukkan adalah lebih baik dalam mengekalkan kekukuhan dalam masa yang sama meningkatkan ketahanan PS. XRD menunjukkan bahawa Graphene juga tersebar dan tertanam dalam fasa PS. Penggubalan 98.5: 1.5 polistirena kepada nisbah graphene telah ditunjukkan bahagian keseimbangan antara kekukuhan dan ketahanan Komposit nano GPS. GPS Komposit nano dipercayai menawarkan kemungkinan boleh digunakan dalam automotif dan perabot aplikasi.