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Mechanical, thermal and dielectric properties of hybrid composites of epoxy and reduced graphene oxide/iron oxide

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ABSTRACT

A hybrid filler (RGO-Fe_2O_3) composed of inorganic nanoparticles of iron oxide (Fe_2O_3) on reduced graphene oxide nanoplatelets (RGO) was successfully synthesized using a microwave assisted chemical reaction. Incorporating RGO-Fe_2O_3 in epoxy through in situ polymerization afforded RGO-Fe_2O_3/epoxy composites. Thermogravimetric analysis demonstrated the thermal stability of RGO-Fe_2O_3/epoxy composites. Improved property profiles of RGO-Fe_2O_3/epoxy were established through electrical conductivity measurements and dielectric properties in the range 40 Hz to 30 MHz and at microwave frequencies in the S band (2-4 GHz) region. Mechanical property measurements were also performed. Dielectric constant, electrical conductivity and absorption coefficient of RGO-Fe_2O_3/epoxy composites were found to be much higher than that of the neat epoxy matrix. Addition of 0.25 phr RGO-Fe_2O_3 increased the tensile strength, flexural strength and impact strength by 56%, 81% & 112% respectively. Fracture toughness determined using single-edge notch three-point-bending specimens also showed an impressive enhancement. Microstructure studies like scanning electron microscopy and transmission electron microscopy demonstrated good interfacial adhesion, the underlying reason for overall improvement in mechanical properties.

Key words: Epoxy Resin; composites; iron oxide; reuced graphene oxide.