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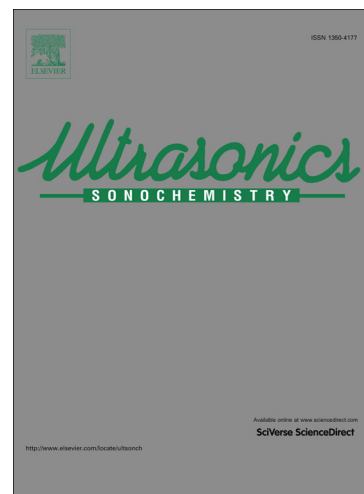
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Ultrasound-assisted synthesis and characterization of magnetite nanoparticles and poly(methyl methacrylate)/magnetite nanocomposites

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Abstract

Poly(methyl methacrylate)/magnetite (PMMA/Fe₃O₄) nanocomposites were prepared with a two-step technique involving sonication. Fe₃O₄ nanoparticles were synthesized by ultrasound-assisted co-precipitation, and then PMMA/Fe₃O₄ (1–5 wt%) nanocomposites were synthesized via ultrasound-assisted in-situ emulsion polymerization. Best physical properties of the nanocomposites for different Fe₃O₄ loadings were: Tensile strength (2 wt%) = 40.28 MPa, Young's modulus (2 wt%) = 2.4 GPa, percentage elongation (2 wt%) = 2.24%, glass transition temperature (2 wt%) = 122.5 °C, thermal inflection point (2 wt%) = 383 °C, electrical conductivity (5 wt%) = 2.0×10^{-13} S/cm, coercivity = 59.85 Oe (2 wt%), magnetic saturation (5 wt%) = 5.12 emu/g, magnetic remanence (5 wt%) = 0.56 emu/g, and electromagnetic interference shielding effectiveness (5 wt%) = 1.45 dB. This unique combination of physical properties at relatively low Fe₃O₄ loading is attributed to ultrasound-mediated uniform dispersion of the nanofiller in the polymer matrix.

Keywords: Nanocomposites, Ultrasound, PMMA, Magnetite, Emulsion polymerization, Electrical conductivity.

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