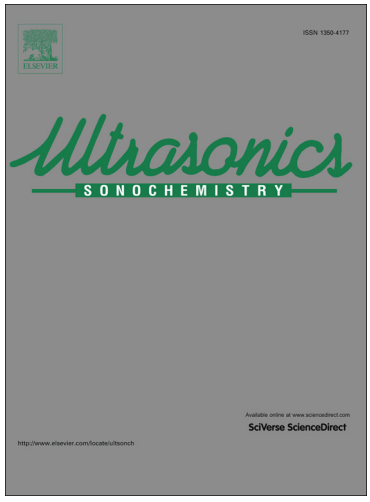

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PII: S1350-4177(17)30609-0
DOI: https://doi.org/10.1016/j.ultsonch.2017.12.035
Reference: ULTSON 4019

To appear in: *Ultrasonics Sonochemistry*

Received Date: 2 November 2017
Revised Date: 17 December 2017
Accepted Date: 17 December 2017

Please cite this article as: M.K. Poddar, M. Arjmand, U. Sundararaj, V.S. Moholkar, Ultrasound-assisted synthesis and characterization of magnetite nanoparticles and poly(methyl methacrylate)/magnetite nanocomposites, *Ultrasonics Sonochemistry* (2017), doi: https://doi.org/10.1016/j.ultsonch.2017.12.035

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

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Abstract

Poly(methyl methacrylate)/magnetite (PMMA/Fe_3O_4) nanocomposites were prepared with a two–step technique involving sonication. Fe_3O_4 nanoparticles were synthesized by ultrasound–assisted co–precipitation, and then PMMA/Fe_3O_4 (1–5 wt%) nanocomposites were synthesized via ultrasound–assisted in–situ emulsion polymerization. Best physical properties of the nanocomposites for different Fe_3O_4 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 $^{\circ}$C, thermal inflection point (2 wt%) = 383 $^{\circ}$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 Fe_3O_4 loading is attributed to ultrasound–mediated uniform dispersion of the nanofiller in the polymer matrix.

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