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Functional nanocomposite polymer films with uniform magnetic nanoparticle dispersions K. STOJAK, S. PAL, M.J. MINER, H. SRIKANTH, University of South Florida-Physics, S. SKIDMORE, J. WANG, T. WELLER, University of South Florida-Electrical Engineering — Magnetic nanoparticles embedded in polymer matrices are good examples of functional nanostructures with excellent potential in applications such as tunable microwave devices, EMI shielding, and flexible electronics. The challenge comes with evenly dispersing the nanoparticles once they are embedded in the polymer matrix. To avoid clustering of particles in the polymer nanocomposites and achieve excellent dispersion, competition between polymer-polymer and polymer-particle interactions must be balanced. In earlier work, we demonstrated the synthesis of 2μm thick, spin-coated nanocomposite PMMA films with Fe_3O_4 (mean size 15nm) nanoparticles embedded that displayed superparamagnetic behavior. In this work we will report on the successful extension of this strategy to 20 μm thick films that are needed for microwave applications. In addition to Fe_3O_4, we have also functionalized the films with other ferrite nanoparticles. Magnetic characterization and microstructural studies of the polymer nanocomposites will be presented and discussed. Microwave response of these films using a coplanar waveguide fixture will also be reported.

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