Fe Polymer Nanocomposites

We have also worked with Dr. S. Hariharan in the Physics Department at USF on the synthesis and characterization of nanoiron/PMMA composites (13-14). We prepared these composites by processing a masterbatch of nanoiron/PMMA in a Banbury mixer. This material was cooled, pulverized and then let down to various concentrations with neat PMMA in the Banbury. Hariharan's group determined that these composites are ferromagnetic at room temperature. The magnetic properties indicate that the composites consisted of a mixture of single-domain and multi-domain structures. This is believed to be the result of some clustering of the nanoparticles. Interestingly, the nanoiron particles plasticized the PMMA matrix at concentrations up to 1wt %. Glass transition temperatures, Vicker's hardness numbers and moduli decreased with iron concentration. Dynamic mechanical analysis revealed that iron particles enhance the gamma transition transition. (The gamma transition responds to mechanical analysis in neat PMMA). The plasticization effects and the enhanced gamma transition effect diminish at higher concentrations of iron where extensive agglomeration is noted by SEM.

References

13. "Synthesis and Magnetic Properties of Polymer Nanocomposites with Embedded Iron Nanoparticles", J. L. Wilson, P. Poddar, N. A. Frey, H. Srikanth, K. Mohomed, J. P. Harmon, S. Kotha, and J. Wachsmuth, Journal of Applied Physics, Vol. 95(3), 1439-1443, (2004).
14. “In-Situ Synthesis and Magnetic Properties of Polystyrene/Polypyrrole Nanocomposite Materials With Uniformly Dispersed Nanoparticles”, H. Srikanth, P. Poddar, J. L. Wilson, K. Mohomed and J. P. Harmon, Materials Research Society Proceedings, Fall 2003, Vol. 788, 1.3.42.1, (2004).