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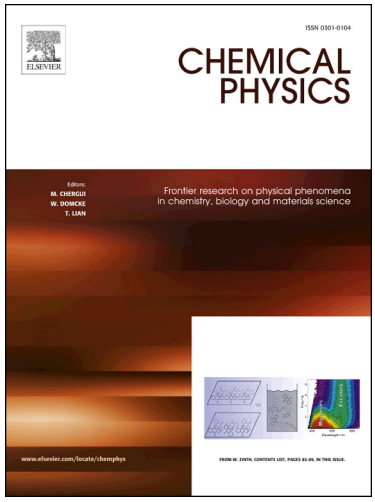

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Influence of various parameters on the performance of superior PFPE-oil-based ferrofluids

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Abstract

Perfluoropolyether acids (PFPE-acids) were used to coat Fe_3O_4 magnetic nanoparticles after the chemical co-precipitation of iron (II & III) salts, following which the well-coated nanoparticles were dispersed in PFPE-oil for preparing superior ferrofluids, especially with high temperature resistance. A thermogravimetric analyzer, transmission electron microscope, vibrating sample magnetometer, X-ray diffractometer, and Fourier transform infrared spectrometer were used to investigate the influences of various factors, such as the chain length, dosage of the PFPE-acids, and pH of the precursor solution, on the performance of the nanoparticles and ferrofluids. Results showed that the coated PFPE-acids did not change the Fe_3O_4 phase, but had an effect on the nanoparticle size and the size distribution. The PFPE-acids were chemically adsorbed on the surface of the nanoparticles via the COO^- electronegative functional groups. The longer-chain-length PFPE-acids adsorbed on the Fe_3O_4 nanoparticles better at high temperatures, whereas the excessively long-chain-length PFPE-acids could hardly be adsorbed. The pH of the precursor solution had a significant effect on the coating of the nanoparticles: the PFPE-acids could not be adsorbed on the nanoparticles when the pH was too