Influence of electric and magnetic fields on dielectric response of oil-based ferrofluid

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The changes in dielectric parameters and structural arrangement of transformer oil-based ferrofluid with magnetic nanoparticles upon the effect of an external magnetic field and an electric field were studied by dielectric spectroscopy. The frequency dependence of complex permittivity and dissipation factor were measured within the frequency range from 1 mHz to 10 kHz by a capacitance method. In whole measured frequency range these parameters have been studied in the magnetic field applied to the sample in either parallel or perpendicular configurations in regard to the electric field. In the presence of the magnetic field the interaction between the magnetic field and magnetic moments of nanoparticles led to the aggregation of magnetic nanoparticles. The electric field also had effects on the reduction in the electric dipole moment of particles and their orientation to the electric field direction connected also with formation of chains. The observed low frequency relaxation maximum of dissipation factor was explained by Schwarz theory of electric double layer polarization. The change of the strength of electric field had influence on this maxima shift what was caused by change of relaxation time of the nanoparticles-counterions system.

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