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Deconvolution of magneto-dielectric relaxation in magnetic fluids stabilised by bilayer and dispersed in mixed oil

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The magneto-dielectric effect in magnetic fluid is extensively studied by many researchers. Schwarz model has examined the particle aggregation in magnetic fluid using dielectric relaxation processes. The presence of agglomeration depends not only on the particle size distribution but also on the type of stabilisation used during synthesis. Also the stability is compromised when the magnetic field and/or temperature exceeds a critical value. The present study aims to understand these two relaxation mechanisms in three different types of fluid with similar size distributions but stabilised differently. The presence of bilayer surfactants on magnetic particle surfaces results in two distinct relaxation processes, when analysing the dielectric dissipation factor spectra as a function of frequency (Figure 1a).

The study highlights the effect of frequencies (0.1 Hz to 200 kHz) under temperature (30 to 60 ℃), with and without DC bias voltages (0 to 3000 mV). To determine the loss due to the relaxation process (tanδr) alone, the loss due to electric conduction (tanδC) was subtracted from the observed loss value (tanδ). The two distinct maxima are observed in the curves, the amplitude at low-frequency peak increases with temperature, while high-frequency peak remains nearly constant. The peak frequency variation with DC-biased voltage for a typical magnetic fluid is shown in Figure 1b. A detailed analysis using Schwarz model will be presented in the paper.

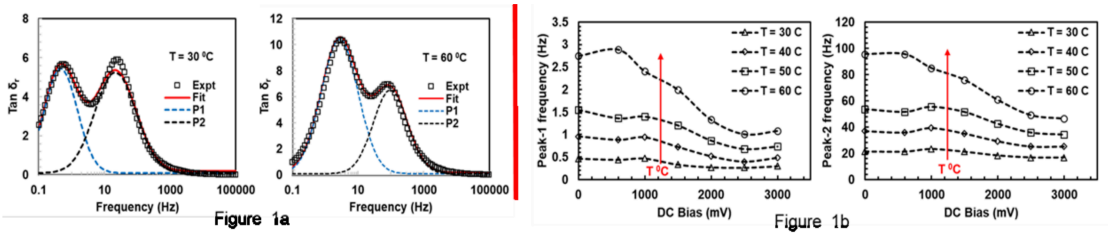

Figure 1: (a) tanδ vs frequency at 30 and 60 ℃, (b) peak 1 and peak 2 vs DC-biased voltage.

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