Influence of electric field on AC magnetic susceptibility of a mineral oil based ferrofluid

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In a ferrofluid the magnetic susceptibility is sensitive to the size and shape of magnetic nanoparticles and their concentration. In this paper we report on the AC magnetic susceptibility of a ferrofluid based on a mineral oil and iron oxide nanoparticles of various concentrations. As this type of ferrofluid is of increasing interest for electrical engineering applications, we investigate the effect of an external electric field and an electric current on the AC magnetic susceptibility at ambient conditions. It is known that the electric field can induce the particle assembling. Then, the structural changes may affect the magnetic susceptibility of the ferrofluid. We observed that the ferrofluid's magnetic susceptibility decreases with increasing electric field. However, a heating effect with increasing electric field was observed too. Hence, it is concluded that besides the structural changes the Joule heating has an impact on the magnetic susceptibility of the ferrofluid in the external electric field.