Thematic area of your work (Nanocomposites and nanomaterials)

Magnetic fluids for electrical engineering applications

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Magnetic fluids are stable colloidal suspensions of permanently magnetized nanoparticles in a nonmagnetic carrier liquid [1]. Among the various technical applications [2], there has been increasing interest in the development of magnetic fluids that meet electrical properties and breakdown requirements of high power transformers. For that purpose, magnetic fluids based on transformer oils have been intensively studied [3]. The essential purpose of the development of such a magnetic colloidal medium and its industrial application consists in the service life extension of millions of aging transformers due to the ferrofluid's enhanced cooling and insulating effectiveness. On the other hand, the transformers with magnetic fluids may be smaller, more efficient and posses improved dielectric capabilities.

In this paper, we focus on recent progress in transformer oil based magnetic fluids research. Besides the basic structural and magnetic properties, we present both thermal and electrical properties of selected magnetic fluids. The cooling effectiveness of the magnetic fluid applied in a model transformer will be shown and compared with that of pure transformer oil. We demonstrate some peculiar structural behavior of the magnetic fluid exposed to external electric fields. It is shown that magnetic nanoparticles in transformer oil can form an electric field driven assembly and patterned structures [4]. The physical conditions allowing the field induced structural changes are therefore discussed too.

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