9.7 cm

Dielectric breakdown strength in magnetic fluids

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The application of external magnetic field on the magnetic fluids induces needle like structuralization of magnetic particles. The influence of this aggregation of magnetic particles in an external magnetic field $\overrightarrow{H}$ on the magneto-dielectric behaviour and dielectric breakdown strength of a transformer oil based magnetic fluid was measured. Magneto-dielectric behaviour showed anisotropy factor $g = 3.4$ (g is defined as ratio of change of dielectric permittivity for $\overrightarrow{H} \| \overrightarrow{E}$ and for $\overrightarrow{E} \perp \overrightarrow{H}$) in contrary with theoretical prediction $g = 2$. This fact indicates developed induced structuralization of magnetic particles. The observed decrease of dielectric breakdown strength (for $H = 0$ and $\overrightarrow{H} \perp \overrightarrow{E}$, where $\overrightarrow{E}$ is applied electric field intensity) vs distance between electrodes is found to be in agreement with a theory of semi-classical bond percolation for a non-linear composite material. The oscillation of dielectric breakdown strength vs distance between electrodes was observed when $\overrightarrow{E} \| \overrightarrow{H}$, i.e. needle-like aggregates are oriented in direction of the applied electric field intensity. This effect is associated with size phenomena probably.

13.4 cm

Subject category :

5. Phase Transitions and Critical Phenomena

Presentation mode :
poster

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