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High magnetic field pulse effect on magnetic and dielectric properties of transfomer oil-based ferrofluids.

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Magnetic fluids as part of dielectric nanofluids have great potential for use in transformers, as they are able to improve the BDV (breakdown voltage) as well as an increase of thermal conductivity. This leads, for example, to a reduction in the size and weight of transformers and an extension of their service life. Understanding the key factors affecting the thermos- dielectric properties of magnetic fluids is of great importance. Among them, aggregation phenomena of magnetic nanoparticles are crucial for the long-term performance of transformers using magnetic fluids. This is the first study of the stability of magnetic fluids under the influence of short intense magnetic pulses (storms) on the stability of a magnetic fluid MF based on transformer oil. In the experiment, MF based on transformer oil Shel DiallS4 with 2.3% volume concentration of magnetite nanoparticles was used. The millisecond pulses up to 7.5 Tesla were generated by discharge of capacitor through an induction coil. The particles of the ferrofluid treated with a single pulse form a branched fractal structure with a fractal dimension Df=1.50 (Fig 1 SAXS/WAXS). Subsequent magnetic field pulses do not lead to visible changes in the structure. Thus, the scattering data indicate a threshold nature of the phenomenon. As a result, they formed developed clusters with sizes above 110 nm, as can be estimated from the minimum value of q. This threshold phenomena is confirmed by magnetic susceptibility measurements Fig1.

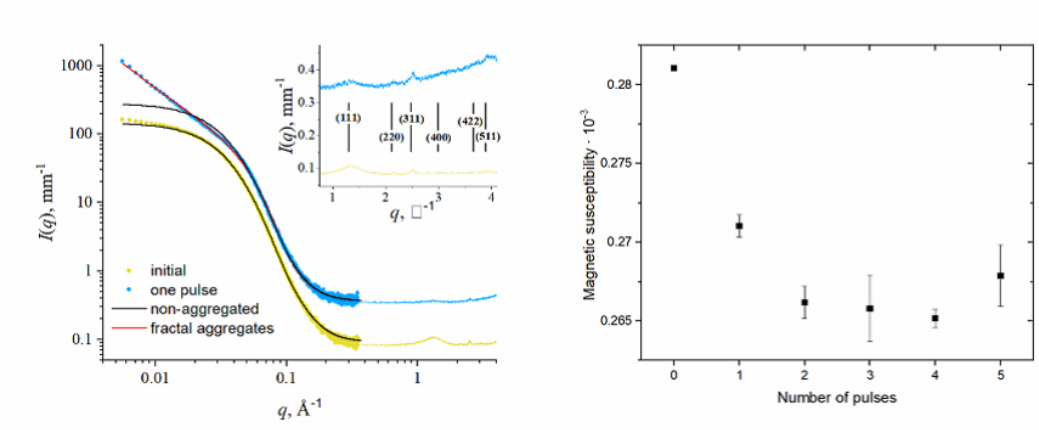

Figure 1: SAXS measurements of MF after one pulse and corresponding magnetic susceptibility as a function of number of 7.5 Tesla pulses.

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