Harmonics distribution of iron oxide nanoparticles solutions under diamagnetic background

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ABSTRACT

The static and dynamic magnetizations of low concentrated multi-core iron oxide nanoparticles solutions were investigated by a specially developed high-Tc Superconducting Quantum Interference Device (SQUID) magnetometer. The size distribution of iron oxide cores was determined from static magnetization curves concerning different concentrations. The simulated harmonics distribution was compared to the experimental results. Effect of the diamagnetic background from carrier liquid to harmonics distribution was investigated with respect to different intensity and position of peaks in the magnetic moment distribution using a numerical simulation. It was found that the diamagnetic background from carrier liquid of iron oxide nanoparticles affected the harmonics distribution as their concentration decreased and depending on their magnetic moment distribution. The first harmonic component was susceptible to the diamagnetic contribution of carrier liquid when the concentration was lower than 24lg/ml. The second and third harmonics were affected when the peak position of magnetic moment distribution was smaller than m = 10_19 Am2 and the concentration was 10ng/ml. A highly sensitive detection up to subnanogram of iron oxide nanoparticles in solutions can be achieved by utilizing second and third harmonic components

KEYWORDS:
Magnetic nanoparticles; Diamagnetism; Water; Harmonics generation; SQUID magnetometer

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