Mechanism for sustainable magnetic nanoparticles under ambient conditions

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Abstract: Iron-based magnetic fluids are widely used in physical applications. Recently, they have been extended to many biological applications due to their magnetic and biocompatible properties. However, their stability under an ambient environment still has not been systematically investigated. In this report, we present the oxidation process of magnetic fluids. The oxidation process depends on the materials that make the nanoparticles, the diffusion of oxygen atoms from the environment to the magnetic nanoparticles, which mainly depends on the viscosity of the solution and the surfactant that coats the nanoparticles. We suggest three ways to protect nanoparticles from oxidation: (a) using highly viscous carrier liquid (b) using relevant surfactants and (c) substitution of Ni^{2+} and Co^{2+} for Fe^{2+} in magnetite. Methods (a) and (b) are general, so they can be applied for many environmentally sensitive magnetic fluids. Method (c) is specific for a magnetite fluid.
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