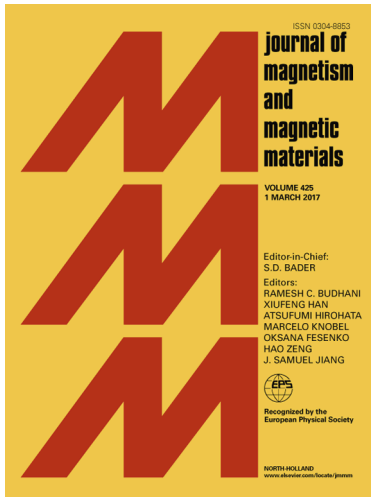

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Characterization of aggregate state of polydisperse ferrofluids: some aspects of anisotropy analysis of 2D SAXS in magnetic field

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Abstract

2D small-angle X-ray scattering (SAXS) patterns for dilute ferrofluids with different degree of particle interaction under external magnetic field are analyzed to obtain structural characteristics of aggregates formed by polydisperse particles. Classical ferrofluids based on organic low-polarity solvents (toluene, decalin) with dispersed nanoparticles of magnetite and cobalt coated with oleic acid and water-based ferrofluid with dispersed magnetite nanoparticles coated with double layer of sodium oleate, are studied. All systems show the Langevin type behavior regarding the orientation of the anisotropic aggregates in them with the saturation at a relatively weak magnetic field strength. The field-induced anisotropy in the SAXS patterns is considered in the frame of a simple approximation.

1. Introduction

The description and regulation of interaction effects in ferrofluids, or magnetic fluids (MFs) where magnetic dipole-dipole interaction is usually suppressed by various coatings of magnetic nanoparticles in liquid carriers are of current interest for developing advanced magnetically sensitive liquid systems in wide range of practical applications [1]. One of the most significant effects in the physics of MFs is the formation of chain-like particle aggregates characterized by a strong shape anisotropy. The behavior of such aggregates can be regulated by external magnetic fields, however, there is a variety of scenarios (chain orientation and growth, chain interaction, formation of secondary