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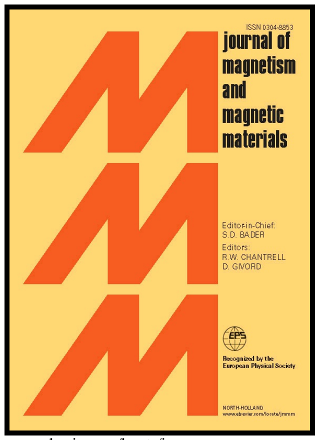

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Constantine V. Yerin

PII: S0304-8853(16)32352-6
DOI: http://dx.doi.org/10.1016/j.jmmm.2016.09.122
Reference: MAGMA61903

To appear in: *Journal of Magnetism and Magnetic Materials*

Received date: 27 June 2016
Revised date: 23 September 2016
Accepted date: 26 September 2016

Cite this article as: Constantine V. Yerin, Particles Size Distribution in Dilutec Magnetic Fluids, *Journal of Magnetism and Magnetic Materials* http://dx.doi.org/10.1016/j.jmmm.2016.09.122

Particles Size Distribution in Diluted Magnetic Fluids

Constantine V. Yerin

North-Caucasus Federal University, Institute of Mathematics and Natural Sciences,
1 Pushkin st., Stavropol, Box. 355009, Russian Federation

Abstract

Changes in particles and aggregates size distribution in diluted kerosene based magnetic fluids is studied by dynamic light scattering method. It has been found that immediately after dilution in magnetic fluids the system of aggregates with sizes ranging from 100-250 nm to 1000 nm is formed. In 50-100 hours after dilution large aggregates are peptized and in the sample stationary particles and aggregates size distribution is fixed.

PACS: 47.65.Cb

Keywords: magnetic fluids, aggregates of magnetic nanoparticles, dynamic light scattering, particles size distribution

1. Introduction

Magnetic fluids (ferrofluids) are colloidal solutions of magnetic nanoparticles in a carrier fluid. The nanoparticles of about 10 nm size consist of a ferri- or ferromagnetic core that is stabilized against aggregation by a shell based on surfactants such as oleic acid. Magnetic fluids are increasingly used for technical, biological and medical applications, such as ferrofluid-based actuators, electromagnetic micropumps, and fluid-based valves and sealing systems, high gradient magnetic separation techniques, magnetic drug targeting, magnetic resonance imaging (MRI) contrast enhancement, cell sorting technology, retinal detachment therapy and hypothermia treatment and measurement of the relaxation of magnetic nanoparticles [1].

In all of the magnetic fluids applications, the particle size remained as the most important parameter as many of the chemical and physical properties associated to nanoparticles are strongly dependent upon the nanoparticle diameter. There are numerous techniques of granulometry, such as transmission electron microscopy (TEM), magnetic measurements, atomic force microscopy (AFM), small angle neutron scattering (SANS) and dynamic light scattering (DLS), that have been employed to measure the size distribution of magnetic fluid's nanoparticles [2].

The advantage of using TEM for determining the particle size distribution is that one physically observes the particles and obtains information about not only particle size but also morphology. The analysis is simple as no fitting or modelling is required. It is also possible to obtain additional functional information about the particles such as chemical composition [3]. The presence of aggregates causes problems in the analysis of particle size as it is debatable whether the particle size should be the aggregate size or the crystallite size [4]. Standard TEM sample preparation as used here can result in the formation of aggregates during the drying of the