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## On the self-assembly of net-like nanostructures in ferrofluids

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### PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS

Volume: 428 Pages: 257-265  
 DOI: 10.1016/j.physa.2015.01.053  
 Published: JUN 15 2015

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### Abstract

Understanding the physical forces that govern nanoparticles self-assembly is central to the ability to engineer super-nanostructures for advanced nanotechnology applications. Magnetic force represents one of such important forces that is responsible for structural transformations and condensation in ferrofluids (FF). In this work, we study internal structural transformations in FF in the absence of external magnetic field by introducing the first direct statistical model that takes into account formation of linear chains, Y-forks and net-like nanostructures. The results show that, in agreement with experiments, when the concentration of the magnetic nanoparticles and their magnetic interaction energy are small enough, majority of the particles are united in individual linear chains. But, when these parameters exceed some threshold magnitude, the main particles population switches to net-like nanostructures. These results highlight the importance of magnetic dipole interactions in the absence of external magnetic field, and their essential role in the bottom-up construction of hierarchical nano-architectures of viable fundamental and practical implications. (C) 2015 Elsevier B.V. All rights reserved.

### Keywords

**Author Keywords:** [Ferrofluids](#); [Self-assembly](#); [Dipole interactions](#); [Condensation](#); [Chains](#); [Net-like nanostructures](#)

**KeyWords Plus:** [DIPOLAR HARD-SPHERES](#); [MAGNETIC FLUIDS](#); [PHASE-TRANSITION](#); [NANOPARTICLES](#); [PARTICLES](#); [LIQUID](#); [NANOWIRES](#); [FERROGELS](#); [NETWORKS](#); [CLUSTERS](#)

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### Funding

Funding Agency	Grant Number
Deanship of Scientific Research (DSR), King Abdulaziz University, Jeddah	247-004-D1433
DSR	
Russian Fund of Fundamental investigations	13-02-91052 13-01-96047 14-19-00989
Program of the Ministry of Education of the Russian Federation	3.12.2014/K
Act 211 Government of the Russian Federation	02.A03.21.0006

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**Categories / Classification****Research Areas:** Physics**Web of Science Categories:** Physics, Multidisciplinary**Document Information****Document Type:** Article**Language:** English**Accession Number:** WOS:000352328100024**ISSN:** 0378-4371**eISSN:** 1873-2119**Journal Information****Table of Contents:** [Current Contents Connect](#)**Impact Factor:** [Journal Citation Reports](#)**Other Information****IDS Number:** CF1SL**Cited References in Web of Science Core Collection:** **47****Times Cited in Web of Science Core Collection:** **2**

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