

MAGNETIC PROPERTIES OF FERROFLUIDS: AN INFLUENCE OF CHAIN AGGREGATES

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The theory of particle association in flexible chains in dilute ferrofluids is generalized to the case of an arbitrarily strengthened magnetic field [1]. The chain distribution in dynamic equilibrium is obtained on the basis of free energy minimization method under the neglect of interchain interaction. The chain partition function is calculated analytically with the help of the rotation matrix technique under the condition when the interparticle dipole-dipole interaction between the nearest neighboring ferroparticles in each chain is taken into account. The interparticle dipole-dipole interaction between all ferroparticles in a magnetic fluid is considered with the help of the modified mean field method [2]. Using the algorithm developed in Ref. [3] the model is extended to bidisperse ferrofluid. The molecular dynamics simulation data on the magnetic properties of aggregated mono- [4] and bidisperse [5] ferrofluids are described. It is shown that the internal chain orientational correlations and the field dependent chain lengthening result in higher magnetization of the aggregated ferrofluid in comparison with the homogeneous one.

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REFERENCES

1. V.S. MENDELEV, A.O. IVANOV. *Phys. Rev. E*, vol. 70 (2004), p. 051502.
2. A.O. IVANOV, O.B. KUZNETSOVA. *Phys. Rev. E*, vol. 64 (2001), p. 041405.
3. A.O. IVANOV, S.S. KANTOROVICH. *Phys. Rev. E*, vol. 70 (2004), p. 021401.
4. Z. WANG, C. HOLM, H.W. MÜLLER. *Phys. Rev. E*, vol. 66 (2002), p. 021405.
5. Z. WANG, C. HOLM. *Phys. Rev. E*, vol. 68 (2003), p. 041401.