

Contents

Synthesis and Characterization

<i>S. Behrens, H. Bönemann, N. Matoussevitch, H. Modrow, V. Kempter, W. Riehemann, A. Wiedenmann, S. Odenbach, S. Will, D. Eberbeck, R. Hergt, R. Müller, K. Landfester, A. Schmidt, D. Schüler, and R. Hempelmann</i>	
1	Characterization Methods 2
2	Synthesis of Magnetic Nanoparticles and Preparation of Magnetic Fluids 24
3	Summary 69
	Acknowledgements 69
	References 69

Thermodynamics, Electrodynamics, and Ferrofluid Dynamics

<i>M. Liu and K. Stierstadt</i> 83	
1	Introduction 83
2	Thermodynamic Derivation of the Maxwell Equations 89
3	The Maxwell Stress and Electromagnetic Forces 96
4	Static Experiments 113
5	Electrodynamics Including Dissipation 118
6	Off-Equilibrium Experiments 132
7	Ferrofluid Dynamics 137
8	Extensions 143
	Appendix A Legendre Transformations of Fields 150
	Appendix B The General Frame Thermodynamic Energy 152
	References 153

Surface Instabilities of Ferrofluids

<i>R. Richter and A. Lange</i> 157	
1	Introduction 158
2	Linear Pattern Formation 164
3	Nonlinear Pattern Formation 177

4	Parametric Excitation of the Surface	215
5	Summary and Outlook	234
	References	236

Ferrofluid Structure and Rheology

<i>P. Ilg and S. Odenbach</i>	249
1 Introduction	249
2 Ferrohydrodynamic Equations and Rheological Quantities	256
3 Microscopic Ferrofluid Model	260
4 Equilibrium Structure and Magnetization	270
5 Kinetic Models of Ferrofluid Dynamics	286
6 Equilibrium Dynamics in Ferrofluids	300
7 Experimental Determination of Rheological and Microstructural Properties	301
8 Conclusions and Perspectives	311
References	315

Biomedical Applications of Magnetic Nanoparticles

<i>L. Trahms</i>	327
1 Introduction	327
2 Magnetic Nanoparticles	329
3 Magnetic Nanoparticles as Labels for Monitoring Biological Binding Reactions	330
4 Magnetic Drug Targeting	336
5 Magnetic Hyperthermia and Thermoablation	343
6 Interactions of Magnetic Nanoparticles on a Cellular Level	351
7 Conclusion	353
References	354

Technical Applications

<i>N. Bayat, A. Nethe, J.M. Guldbakke, J. Hesselbach, V.A. Naletova, H.-D. Stahlmann, E. Uhlmann and K. Zimmermann</i>	359
1 Overview to Technical Applications Using Ferrofluids	359
2 Technical Ferrofluids in Actuators and Electrical Machines	362
3 Biologically Inspired Locomotion Systems	380
4 Ferrofluidic Positioning Systems	394
5 Magnetofluidic Bearings and Dampers	405
6 Extreme Boundary Lubrication	420
References	427