

Contents

1 Introduction	1
References	3
2 Scientific Background	5
2.1 Surface Forces	5
2.1.1 Van der Waals Force	6
2.1.2 Electrostatic Force	7
2.1.3 Depletion Force	9
2.1.4 Structural force	10
2.1.5 Hydrophobic Force	12
2.2 Theoretical Modelings	13
2.2.1 Charged Particles	13
2.2.2 Nonionic Surfactant Micelles	17
References	20
3 Experimental Section	23
3.1 Preparation of Materials	23
3.1.1 Colloidal Nanoparticle Suspensions	23
3.1.2 Surfactant Solutions	23
3.1.3 Micelle Solutions	24
3.1.4 Polyelectrolytes Solutions	24
3.2 Preparation of Different Surfaces	25
3.2.1 Silica Surface	25
3.2.2 Mica Surface	25
3.2.3 Hydrophobic Substrate	26
3.2.4 Polyelectrolyte Layer-by-Layer Adsorption on Surfaces	26
3.3 Methods	27
3.3.1 Atomic Force Microscopy	27
3.3.2 Small Angle X-ray Scattering	33

3.3.3	Other Methods for Solution Characterization	34
3.3.4	Other Methods for Surface Characterization	35
References		36
4	Structuring of Nanoparticle Suspensions Confined Between Two Smooth Solid Surfaces	37
4.1	Introduction	37
4.2	Results	38
4.2.1	Effect of Confinement and Particle Concentration	38
4.2.2	The Influence of Salt	41
4.2.3	Impact of Particle Size	46
4.3	Discussion	51
4.3.1	Scaling Law of the Interparticle Distance	51
4.3.2	Validity of $\lambda_f = 2(R + \kappa^{-1})$	53
4.3.3	Scaling Law of the Correlation Length	55
4.3.4	Dependency of the Particle Interaction Strength	58
4.3.5	Effect of Confinement	59
4.4	Conclusion	60
References		61
5	Structuring of Nanoparticles Between Modified Solid Surfaces	63
5.1	Introduction	63
5.2	Results and Discussion	65
5.2.1	Potential of the Confining Surface	65
5.2.2	Roughness of the Confining Surface	69
5.3	Conclusion	79
References		80
6	Structuring of Nanoparticles Confined Between a Silica Microsphere and an Air Bubble	83
6.1	Introduction	83
6.2	Results	84
6.2.1	Force Profiles in the Absence of Additives	84
6.2.2	Colloidal Nanoparticle Suspensions in the Absence of Surfactants	85
6.2.3	In the Presence of Non-ionic Surfactants	86
6.2.4	In the Presence of Anionic Surfactants	88
6.2.5	In the Presence of Cationic Surfactants	89
6.3	Discussion	91
6.3.1	The Effect of Surface Tension on the Deformability of the Air–Liquid Interface	91
6.3.2	The Effect of Surface Deformability on the Structuring of Nanoparticles	93
6.3.3	AFM Versus TFPB	94

6.4	Conclusions	96
	References	96
7	Structuring of Nonionic Surfactant Micelles	99
7.1	Introduction	99
7.2	Results and Discussion	100
7.2.1	Brij 35: Spherical Micelles	100
7.2.2	Brij 35: Elongated Micelles	105
7.2.3	Tween 20	106
7.2.4	Differences Between Structuring of Nonionic Micelles and Charged Particles	107
7.3	Conclusions	109
	References	110
8	Conclusion and Outlook	113
8.1	Conclusion	113
8.2	Outlook	116
	References	117
	Curriculum Vitae	119