



Influence of a shear flow on colloidal depletion interaction

Christoph July

Forschungszentrum Jülich GmbH
Institute of Complex Systems (ICS)
Soft Condensed Matter (ICS-3)

Influence of a shear flow on colloidal depletion interaction

Christoph July

Schriften des Forschungszentrums Jülich
Reihe Schlüsseltechnologien / Key Technologies

Band / Volume 41

ISSN 1866-1807

ISBN 978-3-89336-791-7

Contents

1	Introduction	1
1.1	Scope of the thesis	1
1.2	Motivation	3
2	Fundamentals	7
2.1	Particle–Wall interactions	7
2.1.1	Gravitation and light forces	7
2.1.2	Double layer forces	9
2.1.2.1	Screened Coulomb potential of a planar wall	9
2.1.2.2	Interaction energy between two planar walls	13
2.1.3	van der Waals forces	16
2.1.3.1	Dipole forces between a sphere and a wall	16
2.1.4	Depletion forces	19
2.1.4.1	Depletion caused by rigid rods	20
2.1.4.2	Depletion caused by infinitely thin platelets	23
2.1.5	Total interaction energy between a sphere and a wall	24
2.2	Total internal reflection	24
3	Experimental methods	27
3.1	TIRM and data analysis	27
3.2	Setup	30
3.2.1	Polarized illumination	33
3.2.2	Detectors	33
3.2.3	Optical tweezers	35
3.2.4	Realization of flow	37
3.2.5	Ensemble measurements	40
3.2.6	TIRF measurements	42
3.3	Measurement errors and limitations	44

3.4	Near wall diffusion	46
3.5	Sample cell preparation	48
3.6	Sample preparation	49
3.6.1	fd virus suspensions	49
3.6.2	Gibbsite platelet suspensions	50
4	Results and Discussion	55
4.1	Tweezers and shear flow	56
4.1.1	Measuring with spatial filtering	56
4.1.2	Measuring without spatial filtering	58
4.2	Depletion caused by fd virus	65
4.2.1	Comparison of wild type fd and Y21M	66
4.2.2	Behaviour at higher fd concentrations	72
4.2.3	Reevaluation of fd depletion data with a modified approach	77
4.2.4	Rod induced depletion in a shear flow	82
4.3	Depletion caused by hard, polydisperse platelets	86
4.3.1	Extending the depletion model	87
4.3.2	Characterizing platelets by TEM measurements	89
4.3.3	TIRF measurements on platelets in quiescent suspensions	90
4.3.4	Platelet induced depletion in shear gradients	95
5	Summary and Outlook	101
	List of Figures	vii
	List of Tables	ix
	Bibliography	xi



Schlüsseltechnologien / Key Technologies
Band / Volume 41
ISBN 978-3-89336-791-7

