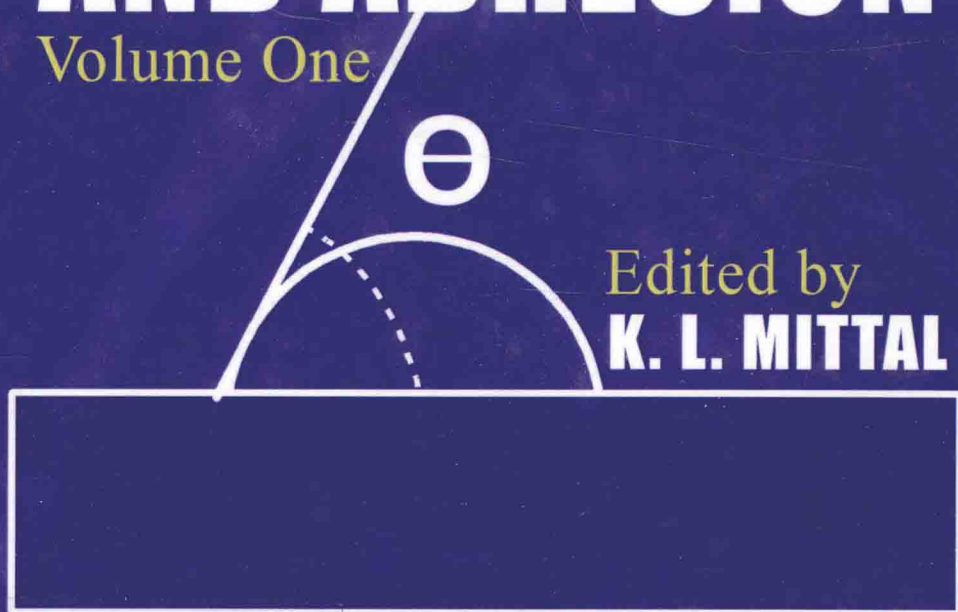


ADVANCES IN CONTACT ANGLE, WETTABILITY AND ADHESION

Volume One



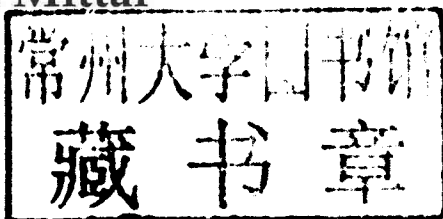
Edited by
K. L. MITTAL

Advances in Contact Angle, Wettability and Adhesion

Volume 1

Edited by

K.L. Mittal



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Adhesion and Adhesives: Fundamental and Applied Aspects

The topics to be covered include, but not limited to, basic and theoretical aspects of adhesion; modeling of adhesion phenomena; mechanisms of adhesion; surface and interfacial analysis and characterization; unraveling of events at interfaces; characterization of interphases; adhesion of thin films and coatings; adhesion aspects in reinforced composites; formation, characterization and durability of adhesive joints; surface preparation methods; polymer surface modification; biological adhesion; particle adhesion; adhesion of metallized plastics; adhesion of diamond-like films; adhesion promoters; contact angle, wettability and adhesion; superhydrophobicity and superhydrophilicity. With regards to adhesives, the Series will include, but not limited to, green adhesives; novel and high-performance adhesives; and medical adhesive applications.

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Preface

The history of contact angle and wetting can be traced back to the early 17th century. The putative seminal paper on this topic was published in 1805 by Thomas Young [An essay on the cohesion of fluids, *Phil. Trans. Roy. Soc.*, 95, 65-87(1805)]. In this paper he describes the balance of various forces (interfacial tensions) acting on a sessile liquid drop on a solid surface, which is popularly known today as the Young's Equation. Apropos, there is no formal equation in this paper. Apparently, some brilliant individual transformed Young's description into this equation. According to Prof. Robert J. Good [R.J. Good, Contact angle, wettability and adhesion, in: *Contact Angle, Wettability and Adhesion*, K.L. Mittal (Ed.) pp. 3-36, VSP, Utrecht 1993] "Most surface and colloid chemists think of Thomas Young as the father of scientific research on contact angles and wetting. But probably the earliest direct recognition of wetting phenomena was given by Galileo [Galileo Galilei, *Bodies that Stay Atop Water, or Move in it* (1612)] who might be called the grandfather of the field."

Another momentous event in this field occurred in 1997 when W. Barthlott and C. Neinhuis [W. Barthlott and C. Neinhuis, Purity of sacred lotus, or escape from contamination in biological surfaces, *Planta*, 202, 1-8(1997)] investigated the wetting properties of various plants and discovered extreme water-repellency (superhydrophobicity) and self-cleaning mechanism of the sacred lotus (*Nelumbo nucifera*) and coined the term "Lotus Effect." Since this discovery, there has been an explosive interest in the topic of superhydrophobicity and a legion of techniques have been described in the literature [see the book A. Carre' and K.L. Mittal (Eds.) *Superhydrophobic Surfaces*, VSP/Brill, Leiden (2009)] to devise mechanically robust superhydrophobic surfaces of a variety of materials. The antonymous field of superhydrophilicity has also attracted fervent interest from the research community. These days there is an ardent interest (both from fundamental and

applied views) in modifying surfaces to alter their wetting behavior to render them superhydrophobic, superhydrophilic, oleophobic, oleophilic, omniphobic, panphobic, amphiphobic. In other words, all kinds of “phobicities” and “philicities” are under intensive investigation.

Even a cursory look at the literature will evince that there is a brisk research activity regarding contact angles and wetting/spreading from both fundamental and applied points of view. The wonderful world of wettability is very wide as it plays an extremely important role in many areas of human endeavor ranging from high-tech (microelectronics, micro- and nanofluidics, MEMS and NEMS, bio-medical devices, for example) to the quite mundane (washing of clothes, spraying of insecticides/pesticides on agricultural products). Researchers have also studied the wettability behavior of skins of people (both males and females) from different origins and backgrounds. I wonder if wettability can be correlated to beauty! I should also add that all signals indicate that the interest in wetting phenomena will continue unabated.

Now coming to this volume, which is essentially based on the written accounts of papers presented at the Eighth International Symposium on Contact Angle, Wettability and Adhesion held in Quebec City, Quebec, Canada during June 13-15, 2012 under the aegis of MST Conferences. It should be recorded for posterity that all manuscripts were rigorously peer-reviewed, suitably revised (some twice or thrice) and properly edited before inclusion in this book. So this book is not a mere collection of unreviewed and unedited papers, rather it represents articles which have passed the rigorous scrutiny. Thus, these articles are of archival value and their standard is as high as any journal or even higher than many journals.

This book containing 22 articles is divided into four Parts as follows. Part 1: Fundamental Aspects; Part 2: Superhydrophobic Surfaces; Part 3: Wettability Modification; and Part 4: Wettability and Surface Free Energy. The topics covered include: contact angle hysteresis on heterogeneous surfaces and in multiphase systems; fundamental understanding of drops wettability behavior; computational aspects of self-cleaning surface mechanisms; utility of imaginary contact angles in the characterization of wettability of rough surfaces; determination of surface free energy at the nanoscale via atomic force microscopy; superhydrophobicity and its assessment criteria; wettability modification techniques for different materials; effects of cold RF plasma treatment on germination rate of plant

seeds; wettability of wood; wettability of DPPC bilayer; wettability, contact angles and surface free energy of solids; influence of surface free energy on friction coefficient between tire and road surface.

It is quite obvious from the above that this book comprising 22 articles written by world-renowned researchers covers many ramifications of contact angles and wettability. It represents a commentary on the contemporary research activity and reflects the cumulative wisdom of a number of key researchers in this arena.

Yours truly sincerely hopes that anyone interested in staying abreast of the latest developments and perspectives in the domain of contact angle, wettability and adhesion will find this compendium of great interest and value. Also I hope the information consolidated in this volume will serve as a fountainhead for new research ideas and applications.

Acknowledgements

Now comes the pleasant task of thanking those who were instrumental in the birth of this book. First and foremost, I would like to express my most sincere thanks to the authors for their interest, enthusiasm, cooperation and contribution, without which this book could not be materialized. Second, my heart-felt thanks go to the unsung heroes(reviewers) for their time and effort in providing invaluable comments which most certainly enhanced the quality of these articles. The comments from the peers are *sine qua non* for maintaining the highest standard of a publication. Last, but not least, I am appreciative of the earnest interest and unwavering help of Martin Scrivener (publisher) in bringing this book to fruition.

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Contents

Preface	xvii
Acknowledgements	xxi
Part 1: Fundamental Aspects	1
1 Correlation between Contact Line Pinning and Contact Angle Hysteresis on Heterogeneous Surfaces: A Review and Discussion	3
<i>Mohammad Amin Sarshar, Wei Xu, and Chang-Hwan Choi</i>	
1.1 Introduction	3
1.2 Contact Line Pinning on Chemically Heterogeneous Flat Surfaces	4
1.3 Contact Line Pinning on Hydrophobic Structured Surfaces	7
1.4 Summary and Conclusion	14
References	15
2 Computational and Experimental Study of Contact Angle Hysteresis in Multiphase Systems	19
<i>Vahid Mortazavi, Vahid Hejazi, Roshan M D'Souza, and Michael Nosonovsky</i>	
2.1 Introduction	19
2.2 Origins of the CA Hysteresis	24
2.3 Modeling Wetting/Dewetting in Multiphase Systems	27
2.3.1 CA in Multiphase Systems	27
2.3.2 CA Hysteresis in Multiphase Systems	28
2.4 Experimental Observations	30
2.5 Numerical Modeling of CA Hysteresis	35
2.5.1 Background	35
2.5.2 The Cellular Potts Model	36

2.5.3	The Cellular Potts Modeling of Wetting	38
2.5.4	Results	40
2.6	Conclusions	44
	Acknowledgement	45
	References	45
3	Heterogeneous Nucleation on a Completely Wettable Substrate	49
	<i>Masao Iwamatsu</i>	
3.1	Introduction	49
3.2	Interface-Displacement Model	51
3.3	Nucleation on a Completely-Wettable Flat Substrate	54
3.3.1	$d = 2$ -dimensional Nucleus	54
3.3.2	$d = 3$ -dimensional Nucleus	62
3.4	Nucleation on a Completely-Wettable Spherical Substrate	65
3.5	Conclusion	69
	Acknowledgments	70
	References	70
4	Local Wetting at Contact Line on Textured Hydrophobic Surfaces	73
	<i>Ri Li and Yanguang Shan</i>	
4.1	Introduction	73
4.2	Static Contact Angle	76
4.2.1	Global Approach – Thermodynamic Equilibrium	77
4.2.2	Local Approach – Force Balance	79
4.3	Wetting of Single Texture Element	80
4.4	Summary	85
	References	85
5	Fundamental Understanding of Drops Wettability Behavior Theoretically and Experimentally	87
	<i>Hartmann E. N'guessan, Robert White, Aisha Leh, Arnab Baksi, and Rafael Tadmor</i>	
5.1	Introduction	87
5.2	Discussion	90
5.3	Conclusion	93
	References	94

6	Hierarchical Structures Obtained by Breath Figures Self-Assembly and Chemical Etching and their Wetting Properties	97
	<i>Edward Bormashenko, Sagi Balter, Roman Grynyov, and Doron Aurbach</i>	
6.1	Introduction	97
6.2	Materials and Methods	98
6.2.1	Fabricating Hierarchical Polymer Surfaces	98
6.2.2	Characterization of the Wetting Properties of Polymer Surfaces	99
6.2.3	Plasma Treatment of the Surfaces	99
6.2.4	B.E.T Characterization of the Surfaces	100
6.3	Results and Discussion	100
6.3.1	Morphology and Wetting Properties of the Multi-scaled PC Surfaces	100
6.3.2	Modification of Wetting Properties of the Multi-scaled Surfaces with Cold Radiofrequency Plasma Treatment	103
6.3.3	B.E.T Study of the Surfaces	104
6.4	Conclusions	105
	Acknowledgements	105
	References	105
7	Computational Aspects of Self-Cleaning Surface Mechanisms	109
	<i>Muhammad Osman, Raheel Rasool, and Roger A. Sauer</i>	
7.1	Introduction	109
7.2	Droplet Membrane	111
7.2.1	Governing Equations in Strong Form	111
7.2.1.1	Surface Contact	112
7.2.1.2	Line Contact	113
7.2.1.3	Surface Roughness	113
7.2.2	Weak Formulation of the Governing Equations	114
7.2.2.1	Finite Element Implementation	116
7.2.3	Model Verification	117
7.2.3.1	Force Equilibrium	117
7.2.4	Particle-Droplet Interaction	119

7.3	Flow Model	121
7.3.1	Governing Equations	121
7.3.2	Finite Element Implementation	122
7.3.3	Normal and Tangential Velocities at the Boundary	125
7.4	Results	126
7.4.1	Multiscale View of Contact	126
7.4.2	Computational Membrane Model	127
7.4.3	Liquid Flow Model	127
7.4.4	Particle-Droplet Interaction	128
7.5	Summary	129
	Acknowledgement	129
	References	129
8	Study of Material–Water Interactions Using the Wilhelmy Plate Method	131
	<i>Eric Tomasetti, Sylvie Derclaye, Mary-Hélène Delvaux, and Paul G. Rouxhet</i>	
8.1	Introduction	132
8.2	Upgrading Wetting Curves	133
8.3	Study of Surface-Oxidized Polyethylene	136
8.3.1	Introduction	136
8.3.2	Experimental	137
8.3.3	Results and Discussion	138
	8.3.3.1 Surface Morphology and Composition	138
	8.3.3.2 Water Retention upon Emersion	138
	8.3.3.3 Surface Reorganization According to the Environment	141
8.3.4	Conclusion	143
8.4	Study of Amphiphilic UV-Cured Coatings	143
8.4.1	Introduction	143
8.4.2	Experimental	144
8.4.3	Results and Discussion	144
	8.4.3.1 Surface Morphology and Composition	144
	8.4.3.2 Wetting Measurements	148
8.4.4	Conclusion	151

8.5 Conclusion	151
Acknowledgements	152
References	152
9 On the Utility of Imaginary Contact Angles in the Characterization of Wettability of Rough Medicinal Hydrophilic Titanium	155
<i>S. Lüers, C. Seitz, M. Laub, and H.P. Jennissen</i>	
9.1 Introduction	156
9.2 Theoretical Considerations	156
9.2.1 Mathematical Basis	156
9.2.2 Physical Basis	157
9.3 Materials and Methods	158
9.3.1 Titanium Miniplates	158
9.3.2 Profilometric Surface Roughness	159
9.3.3 Contact Angle Measurements	159
9.3.4 Baseline Correction	159
9.3.5 Calculation of Contact Angles	160
9.3.6 Determination of Wetting Times	160
9.3.7 SEM	160
9.3.8 Nomenclature	160
9.4 Results and Discussion	161
9.4.1 SEM of the uSLA Surface	161
9.4.2 Characterization of Wetting of uSLA Surfaces	162
9.4.2.1 Ti-uSLA Surface Immediately after Etching	162
9.4.2.2 Ti-uSLA Surface after 24 Hours in 100 mM KH_2PO_4 , pH 7.6 (Wet Storage)	164
9.4.2.3 Ti-uSLA Surface Stabilization by an Exsiccation Layer of Salt for 24 Hours (Dry Storage)	168
9.4.2.4 Hybrid Contact Angles on Ti-uSLA Surface	169
9.4.2.5 Wetting Times of Ti-uSLA Miniplates	169

x CONTENTS

9.5 Conclusion	171
Acknowledgement	171
References	171
10 Determination of Surface Free Energy at the Nanoscale via Atomic Force Microscopy without Altering the Original Morphology	173
<i>L. Mazzola and A. Galderisi</i>	
10.1 Introduction	174
10.2 Materials and Methods	175
10.2.1 Nanoindentation Setup	175
10.2.2 Atomic Force Microscopy Setup	176
10.2.3 Focused Ion Beam Analysis	178
10.2.4 Profilometric Analysis	179
10.3 Results and Discussion	180
10.3.1 Results	180
10.3.2 Discussion	181
10.3.3 Applications	186
10.4 Conclusion	188
References	188
Part 2: Superhydrophobic Surfaces	191
11 Assessment Criteria for Superhydrophobic Surfaces with Stochastic Roughness	193
<i>Angela Duparré and Luisa Coriand</i>	
11.1 Introduction	193
11.2 Model and Experiments	194
11.2.1 Roughness Model and Data Analysis	194
11.2.2 Roughness and Contact Angle Measurements	196
11.2.3 Nanorough Coatings	196
11.3 Results and Discussion	197
11.4 Summary	200
Acknowledgement	200
References	201