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[CONTACT ANGLE: THE PHENOMENA WITH ENDLESS APPLICATIONS](#)

EDITORIAL COMMENTS

This issue of the newsletter further pursues the topic of contact angle phenomena and its many applications. It seems that just when you think you have heard about every possible application something new and wholly unexpected pops up. Our Colleague Carl Clegg at the Rame-Hart company has documented some 50 applications of contact angle measurements ranging from using contact angle to develop surface treatments to prevent ice build-up on long-distance high-voltage power transmission lines to improving biocompatibility of polymer-based medical devices. The complete story is available on Carl's web page at

(www.ramehart.com/newsletters/2010-12_news.htm).

Thus I am surprised to learn that contact angle measurements can be used to monitor the adhesion of decay causing proteins on tooth enamel which forms the subject of this issues editorial essay.

In addition this issue of the NEWSLETTER presents the final program for the upcoming 10th in the symposium series on CONTACT ANGLE, WETTABILITY AND ADHESION which will be held July 13-15, 2016 at the Stevens Institute of Technology in Hoboken, New Jersey. All readers of the newsletter are invited to join us at the Stevens Institute for what promises to be a most engaging and informative meeting

Finally we would like to bring every ones attention to the next session of the short course on:

THE CHEMISTRY, PHYSICS AND MECHANICS OF ADHESION SCIENCE

The course will be given again this coming November, 2016 at the Marriott Inn in Newburgh, NY and all readers of the NEWSLETTER are invited to join us this coming November in Newburgh or simply

to pass the word along to colleagues or associates who might be interested. Further details will be available shortly on the conference web site by clicking on

www.mstconf.com/AdhesionCourse.htm

EDITORIAL ESSAY:

Biofilms

The contact angle measurement technique has been making significant inroads into the biological sciences and this trend is highlighted in a recent paper in the Proceedings of the National Academy of Sciences (PNAS)¹. The authors have used the contact angle method to uncover a most remarkable property of bacterial biofilms. It should be explained that most of the bacteria on the planet do not spend that much time floating around as individual cells looking for some host to settle on. As single cells they are highly susceptible to many hostile elements such as predation by other microbes, attack by antibiotics and antigens, ... etc. In most cases, especially when conditions for growth are poor, bacteria tend to settle into colonies known as biofilms. Dental plaque is a common example of a biofilm. According to the authors:

Contrary to what was believed as recently as 20 years ago, bacteria exist in nature predominantly as members of biofilms structured, multicellular communities adherent to surfaces in natural and man-made environments². Biofilm formation is

¹ Bacterial biofilm shows persistent resistance to liquid wetting and gas penetration, Alexander K. Epstein, Boaz Pokroy, Agnese Seminara and Joanna Aizenberg, PNAS, January 18, 2011, vol. 108, no. 3, 995-1000.

² Aguilar C, Vlamakis H, Losick R, Kolter R (2007) Thinking about *Bacillus subtilis* as a multicellular organism. *Curr Opin Microbiol* 10:638-643.

now known to cause contamination of plumbing, oil wells, medical implants, building heating, ventilation, air conditioning and other systems³ and is largely responsible for nearly 100,000 nosocomial deaths annually in the United States and 80% or more of all microbial infections in humans^{4 5}.

The authors performed contact angle measurements on biofilms formed by the *B. Subtilis* organism which is commonly found in water, soil, air and decomposing plant residue. Their results illustrated in Fig.(1) dramatically illustrate the level of protection which the biofilm provides to the bacterial colony. The figure illustrates the level of water/ethanol repellence of the biofilm compared to teflon out to as high as 80% ethanol which would be an extremely toxic concentration for individual free swimming bacteria. The data also raise a very important question as to how to best control unwanted microbial contamination from surfaces. In particular, the use of antibacterial soaps and other bacteriocides which rely on liquid penetration to the surface of the individual bacterial cell are unlikely to be very effective once a biofilm has formed. Though it may be unclear as to the best way to proceed at the moment it is unquestionably clear that issues of surface chemistry and surface physics will have to be addressed before much progress can be

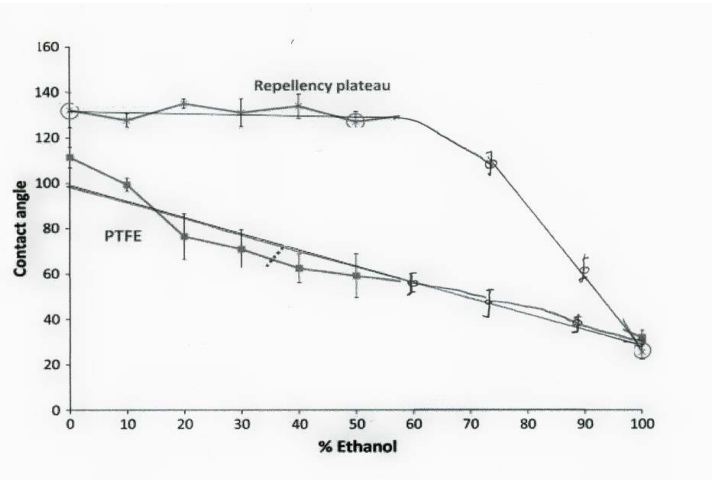


Figure 1 Contact angle data of drops of water/ethanol mixtures performed on a *B. Subtilis* biofilm and for comparison on a film of poly(tetra fluoro-ethylene) PTFE.

made and the contact angle method is sure to be in the vanguard of the weapons used to attack this problem.

Measuring Protein Adhesion

More recent work by investigators at the DataPhysics company have carried this type of investigation down to the molecular level again by investigating the problem of dental tooth decay. Tooth decay usually starts with the adsorption of proteins on the enamel. This process was studied at different pH values using as test system the protein bovine serum albumin (BSA) and enamel slices of defined size.

The properties of the enamel surface

³Costerton JW, Stewart PS (2001) Battling biofilms—The war is against bacterial colonies that cause some of the most tenacious infections known. The weapon is knowledge of the enemy's communication system. *Sci Am* 285(1): 74–81.

⁴Davies D (2003) Understanding biofilm resistance to antibacterial agents. *Nat Rev Drug Discov* 2:114–122.

⁵Klevens RM, et al. (2007) Estimating health care-associated infections and deaths in US hospitals, 2002. *Public Health Rep* 122:160–166.

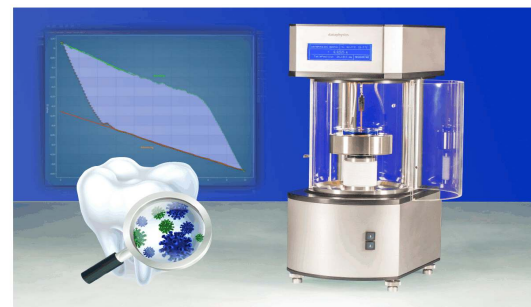
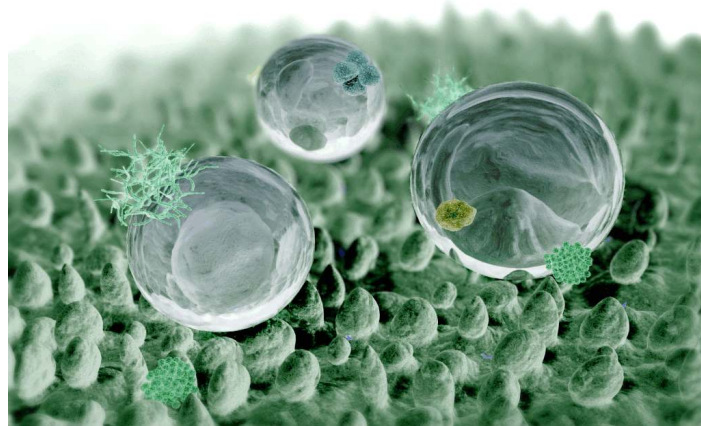


Figure 2 DCAT-11 tensiometer from DataPhysics.

changes when protein is adsorbed. This is reflected by changes of the contact angle and the contact angle hysteresis (= difference between advancing and receding contact angles). For measuring the dynamic contact angles there are different possibilities. One option is to use an optical contour analysis system like an OCA instrument from DataPhysics Instruments, Germany. In this case one dose a little droplet of solution on the studied surface and either changes the droplet volume or tilts the surface until the droplet rolls off. This set-up, however, does not mimic very well the situation of a tooth which is surrounded by saliva. Option two, namely a tensiometric measurement of the dynamic contact angles using the Wilhelmy method, mimics the situation much better: here the studied surface is dipped into a large volume of liquid. For the protein adsorption study enamel slices were dipped repeatedly into BSA solution (20 g/l) using the tensiometer DCAT 11 from DataPhysics Instruments, Germany shown in Fig. (2) (Visit www.dataphysics.de for full details). The protein could freely diffuse to and away from the surface where it adsorbed. Adsorption was followed over time monitoring the contact angle hysteresis which eventually reached an equilibrium value.

Experiments at different pH values revealed a higher hysteresis at higher pH, i.e. in alkaline environment. In the same time the adsorption is slowed down such that the equilibrium value is only reached later while a following desorption of proteins, dipping the enamel with adsorbed BSA into pure water, is faster at higher pH. This can be explained by electrostatic forces. At high pH both the enamel and the BSA are charged negatively which leads to repulsion.

Readers who have a further interest in this type of investigation can meet representatives of the DataPhysics company at the upcoming TENTH



INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION; Details of this meeting and the final program follow:

FINAL PROGRAM

TENTH INTERNATIONAL SYMPOSIUM ON: CONTACT ANGLE, WETTABILITY AND ADHESION

Stevens Institute of Technology, Hoboken, New Jersey, USA, July 13-15, 2016

SYMPOSIUM HISTORY AND MOTIVATION

In his opening remarks at the first symposium in this series Professor Robert Good pointed out that Galileo in the 17th century was quite likely the first investigator to observe contact angle behavior with his experiment of floating a thin gold leaf on top of a water surface. Since that time contact angle measurements have found wide application as a method for determining the energetics of surfaces. This, in turn, has a profound effect on the wettability and adhesion of liquids and coatings to surfaces.

This symposium is concerned with both the fundamental and applied aspects of contact angle measurements. Issues such as the applicability and validity of various

measurement techniques and the proper theoretical framework for the analysis of contact angle data are of prime concern.

In addition, a host of applications of the contact angle technique are explored including but not limited to: wettability of powders, fibers, wood products, paper, polymers and monolayers. Further focus is on the use of contact angle data in evaluating surface modification procedures, determining relevance of wettability to adhesion, the role of wettability in bioadhesion, ophthalmology, prosthesis and in the control of dust in mining and milling applications.

ORGANIZERS AND CONTACT INFORMATION

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PROGRAM SESSIONS

SESSION I: WEDNESDAY, JULY 13, 2016

8:35-9:05: [Edward Bormashenko](#), Yelena Bormashenko, Roman Grynyov, Hadas Aharoni, Gene Whyman and Bernard P. Binks; Ariel University, Physics Department, P.O.B. 3, 40700, Ariel, ISRAEL; Self-Propulsion of Liquid Marbles: Leidenfrost-Like Levitation Driven by the Marangoni Flow

9:05-9:35: M. F. Ismail and [Prashant R. Waghmare](#); Interfacial Science and Surface Engineering Lab, Department of Mechanical Engineering, University of Alberta, Edmonton, CANADA, T6G 2G8; Universality in Freezing of Asymmetric Drop

9:35-10:05: Ming Jin, Daniel Frese, Carsten Scheithauer, and [Thomas Willers](#); KRÜSS GmbH, Borsteler Chaussee 85, 22453 Hamburg, GERMANY; Raymond Sanedrin; KRÜSS USA, 1020 Crews Road, Matthews, NC 28105, USA; Replacing the Solid Needle by a Liquid One When Measuring Static and Advancing Contact Angles

10:05-10:35: [Michael Schmitt](#) and Florian Heib; Physical Chemistry, Campus B 2 2, Saarland University, 66123 Saarbrücken, GERMANY; Fundamentals of Reproducible/Enhanced Contact Angle Analyses

10:35-10:50: COFFEE BREAK

10:50-11:10: Sara L. Schellbach, Sergio N. Monteiro and [Jaroslaw W. Drelich](#); Department of Materials Science and Engineering, Michigan Technological University, 1400 Townsend Dr., Houghton, MI 49931, USA; A Novel Method for Contact Angle Measurements on Natural Fibers having Non-Uniform

Cross Sections and Rough Surface

11:10-11:40: H. Jennissen; Institute of Physiological Chemistry, University of Duisburg-Essen, Hufelandstr. 55, D-45122 Essen, GERMANY; Complex and Imaginary Contact Angles: A Radically New Development for Advancing Our Understanding of Wetting, or Just a Whim of Applied Mathematics?

11:40-12:00: Masaki Yamaguchi, Tetsuhiro Sakata, Shunsuke Tamura and Kensuke Yokoi; Graduate School of Science & Technology, Shinshu University, 3-15-1 Tokida, Ueda, Nagano 386-8567, JAPAN; Numerical Studies of Dynamic Droplet Moving for Fluid Analysis

12:00-1:00: LUNCH

SESSION II: WEDNESDAY JULY, 13, 2016

1:00-1:30: Meenakshi Annamalai and Thirumalai Venkatesan; Nanoscience and Nanotechnology Institute (NUSNNI) – Nanocore, 5A Engineering Drive 1, T-Lab Building, National University of Singapore, SINGAPORE 117411; Wetting Studies at Macro and Nanoscale

1:30-2:00: Luisa Coriand, Nadja Felde, Susanne Pfeifenbring, and Angela Duparré; Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Strasse 7, 07745 Jena, GERMANY; Investigation of Oleophilic and Oleophobic Nanorough Surfaces Immersed in Air or Water

2:00-2:30: Chunlei Wang; Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Jialuo Road 2019, Jiading Shanghai, Shanghai 201800, CHINA; Ordered Water Monolayer That Does Not Completely Wet Water and Molecular-scale Hydrophilicity at Room Temperature

2:30-3:00: Junqi Yuan, Jian Feng and Sung Kwon Cho; Dept. of Mechanical Engg. & Materials Science, University of Pittsburgh, Pittsburgh, PA 15261; Control of Floating Objects by Di-electrowetting

3:00-3:30: D. Panchanathan, G. Kwon, K. K. Varanasi and G. H. McKinley; Dept. of Mechanical Engg., MIT, Cambridge, MA 02139; Quantifying the Kinetics of Photocatalysis on Nanoporous Titania Surfaces using Contact Angle Goniometry

3:30-3:45: COFFEE BREAK

3:45-4:05: Choongyeop Lee, Seunggeol Ryu and Youngsuk Nam; Department of Mechanical Engineering, Kyung Hee University, Yongin-city, KOREA; Water Penetration Through Copper Mesh During Drop Impact: Influence of Surface Wettability

4:05-4:25: M.-L. Giorgi, J.-M. Mataire and A. Koltsov; Laboratoire de Génie des procédés et matériaux (LGPM) CentraleSupélec, Université Paris-Saclay, Grande Voie des Vignes, 92295 Châtenay-Malabry Cedex, FRANCE; Influence of Kinetic Energy on Wetting of Steel Surfaces by Liquid Zinc in Two Conditions : Sessile Droplet and Continuous Galvanizing

4:25-4:45: M. Diallo, H. Duval, A. Koltsov, J.-M. Mataire and M.-L. Giorgi; Laboratoire de Génie des procédés et matériaux (LGPM) CentraleSupélec, Université Paris-Saclay, FRANCE; Wetting Dynamics of Liquid Lead on Silica-patterned Iron

4:45-5:05: Kirill A. Emelyanenko, Alexandre M. Emelyanenko and Ludmila B. Boinovich; A.N. Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Leninsky prospect 31 bldg. 4, 119071 Moscow, RUSSIA; The Description of Wetting Behavior of Alkanes on Water with Accounting for Water Solubility and Image Charge Effects

5:05-5:35: Ajay Kadiyala and Jayashree Bijwe; ITMMEC, Indian Institute of Technology Delhi, INDIA; Micro and Nano SiC Based Polyether Ether Ketone (PEEK) Coating on Stainless Steel: Tribology and Surface Energy Correlation Studies

5:35-5:55: Mikalai Krutsko, Natallia Yakavets, and Olga Opanasenko; The Institute of General and Inorganic Chemistry of the National Academy of Sciences, Minsk, BELARUS; Surface Wetting of Oil Resin-Asphaltene Substances Modified by Surfactants

SESSION III: THURSDAY, JULY 14, 2016

8:30-9:00: Adya Karthikeyan, Sylvain Coulombe and Anne-Marie Kietzig; Chemical Engineering Department, McGill University, Montreal, CANADA; Surface Wetting and Surface Tension of Stable and Unstable Carbon Nanotube Nanofluids

9:00-9:30: Eric Loth; University of Virginia, Room 308 MEC, 122 Engineer's Way, P.O. Box 400746, Charlottesville, VA 22904; Micro-dynamics of Wetting (High Spatial and Temporal Resolution)

9:30-10:00: D.G. Waugh, J. Lawrence, A. Gillett and C.H. Ng; Laser Engineering and Manufacturing Research Group, Faculty of Science and Engineering, University of Chester, Thornton Science Park, Pool Lane, Ince, Chester CH2 4PU, UK ; Laser Surface Treatment: Modulating Wettability Characteristics of Materials to Control Biological Cell Adhesion and Growth

10:00-10:30: Digvijay Singh and Robert Baier; State University of New York at Buffalo, Buffalo, NY; Contact Angle and Wettability Correlations for Bioadhesion to Reference Polymers, Metals, Ceramics and Tissues

10:30-10:45: COFFEE BREAK

10:45-11:05: Edward Bormashenko; The Ariel University Center of Samaria, 40700 Ariel, ISRAEL; Cold Plasma Treatment of Liquid Surfaces

11:05-11:25: Edward Bormashenko; The Ariel University Center of Samaria, 40700, Ariel, ISRAEL; Electrical Charging of Surfaces under the Cold Plasma Treatment

11:25-11:55: Thomas Bahners, Milan Kelch, Jochen S. Gutmann and Jörg Müssig; Deutsches Textilforschungszentrum Nord- West gGmbH, Krefeld GERMANY; Improvement of Fiber- Matrix Adhesion and Damping in Cellulose/Polyolefin Composite Materials by Means of Photochemical Fiber Surface Modification

11:55-1:00: LUNCH

SESSION IV: THURSDAY, JULY 14,
2016

1:00-1:30: Lasse Makkonen; VTT
Technical Research Centre of Finland, Box
1000, 02044 VTT, FINLAND; A
Quantitative Theory of Contact Angle
Hysteresis

1:30-1:50: Youhua Jiang, Wei Xu,
Mohammad Amin Sarshar and
Chang-Hwan Choi; Department of
Mechanical Engineering, Stevens Institute
of Technology, Hoboken, New Jersey, USA;
A Generalized Model of Advancing and
Receding Contact Angles for Patterned
Surfaces

1:50-2:10: Lasse Makkonen; VTT
Technical Research Centre of Finland, Box
1000, 02044 VTT, FINLAND; Young's
Equation Revisited

2:10-2:30: Birgitt Boschitsch Stogin,
Xianming Dai, and Tak-Sing Wong;
Department of Mechanical and Nuclear
Engineering and the Materials Research
Institute, The Pennsylvania State
University, University Park, PA, USA;
Wenzel Wetting on Slippery Rough
Surfaces

2:30-3:00: Frank M. Etzler, School of
Pharmacy, LECOM, 1858 W. Grandview
Blvd., Erie, PA 16509; Statistical
Considerations for the Evaluation of
Surface Free Energies from Contact
Angle Data

3:00-3:30: Konrad Terpiłowski Marta
Tomczyńska-Mleko, Stanisław Mleko and
Emil Chibowski; Department of Physical
Chemistry-Interfacial Phenomena, Maria
Curie Skłodowska University, Lublin,
POLAND; The Surface Properties of
Biopolymers Obtained with the
Presence of Gluten

3:30-3:45: COFFEE BREAK

3:45-4:05: Lasse Makkonen; VTT
Technical Research Centre of Finland, Box
1000, 02044 VTT, FINLAND;
Determining the Surface Energy of a
Solid by Contact Angles

4:05-4:25: Hana Sourková; Technical
University of Liberec, Faculty of
Mechatronics, Informatics and
Interdisciplinary Studies, Studentská
1402/2, Liberec: 461 17, CZECH
REPUBLIC; Surface Tension
Characterization of Plasma Treated
Powders as a Process Control for
Industrial Application

4:25-4:45: Davide Rossi , Antonio
Bettero, Nicola Realdon and Paola Pittia;
Department of Pharmaceutical and
Pharmacological Sciences, University of
Padova, ITALY; Development of a
Method for Contact Angles
Measurements at
Perfluoropolyether/perfluoropolyether
Interface Employing Fomblin HC/25
PFPE as " Fluid Film " for Surface
Energy Characterization of Some
Water Solutions

4:45-5:15: D. K. Sarkar; Centre
Universitaire de Recherche sur l'Aluminium
(CURAL), Université du Québec à
Chicoutimi, 555 Boulevard de l'Université,
Chicoutimi, Québec, CANADA G7H 2B1;
Studies of Corrosion Properties of
Nanostructured Superhydrophobic
Thin Films on Metals

5:15-5:45: Kock-Yee Law; Research
and Innovative Solutions, 27 Valewood
Run, Penfield, NY 14526; Wettable
Slippery Surfaces. Self-cleaning Effect
and Mechanism

5:45-6:05: Daniel Scholz; DataPhysics
Instruments GmbH, Raiffeisenstrasse 34,
70794 Filderstadt, GERMANY; Measuring
Adhesive Forces of Liquids on Solid
Surfaces using a Tensiometer

SESSION V: FRIDAY, JULY 15, 2016

8:30-9:00: G. Paz-Gómez, M.J. Otero-Díaz, J.A. del Caño-Ochoa, Clara Moyano, G.R. Guerrero, M.A. Cabrerizo-Vílchez and M.A. Rodríguez-Valverde; Biocolloid and Fluid Physics Group, Department of Applied Physics, University of Granada, SPAIN; Water-Repellent Non-stick Coatings

9:00-9:30: Hernando S. Salapare III and Frédéric Guittard; Université de Nice-Sophia Antipolis, CNRS, Laboratoire de Physique de la Matière Condensée (LPMC), UMR 7336, Parc Valrose, 06100 Nice, FRANCE; Superhydrophobicity of Candle Soot Film Deposited on Rf Plasma-treated Poly(ethylene glycol-co-1,3/1,4 cyclohexanedimethanol terephthalate) (PETG)

9:30-10:00: Savvas G. Hatzikiriakos; Department of Chemical and Biological Engineering, The University of British Columbia, Vancouver BC, V6T 1Z3, CANADA; Controlled-Superhydrophobicity on Metallic Substrates Using Fs Laser Ablation

10:00-10:30: Michele Ferrari, Francesca Cirisano, Alessandro Benedetti, Libero Liggieri, Francesca Ravera and Eva Santini; CNR – Istituto per l' Energetica e le Interfasi, 16149 Genova, ITALY; Amphiphobic Coatings for Protection in Seawater Environment

10:30-10:45: COFFEE BREAK

10:45-11:15: Ludmila Boinovich and A.Emelyanenko; Institute of Physical Chemistry & Electrochemistry, Leninsky Prospect 31, Moscow 119991, RUSSIA; Surfactant Induced Deviation in Wetting Behaviour of Superhydrophobic Surfaces

11:15-11:35:

Alexandre M. Emelyanenko, Ludmila B. Boinovich, Kirill A. Emelyanenko, and Alexandr G. Domantovsky; A.N. Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Leninsky prospect 31 bldg. 4, 119071 Moscow, RUSSIA; Nanosecond Laser Micro and Nanotexturing for the Design of Superhydrophobic Coatings Robust to Long-term Contact with Water, Corrosion Active Medium, Cavitation, and Abrasion

11:35-11:55: Ali Kibar, Ridvan Ozbay, and Chang-Hwan Choi; Department of Mechanical and Material Technologies, Kocaeli University, Arslanbey Campus, Kocaeli 41285, TURKEY; Air Bubble Detachment on Superhydrophobic Surfaces

11:55-1:00: LUNCH

SESSION VI: FRIDAY, JULY 15, 2016

1:00-1:20: Junghoon Lee, Youhua Jiang and Chang-Hwan Choi; Department of Mechanical Engineering, Stevens Institute of Technology, Castle Point on Hudson, N J 07030; Oil-Impregnated Anodic Aluminum Oxide Layers for Omniphobic Surfaces

1:20-1:40: Ridvan Ozbay, Ali Kibar, and Chang-Hwan Choi; Department of Mechanical Engineering, Stevens Institute of Technology, Hoboken, N J 07030; Bubble Adhesion on Superaerophobic Surfaces: Effects of Surface Morphology

1:40-2:00: Mohammad Amin Sarshar, Chris Swartz and Chang-Hwan Choi; Department of Mechanical Engineering, Stevens Institute of Technology, Hoboken, NJ 07030; Icephobicity of Superhydrophobic Surfaces: Effects of Environmental Conditions

2:00-2:20: Pan Guo, Yusong Tu, Jinrong Yang, Chunlei Wang, Nan Sheng, and Haiping Fang; College of Physics Science and Technology, Yangzhou University, 88 South University Ave., Yangzhou, Jiangsu 225009, P.R. CHINA; Water-COOH Composite Structure with Enhanced Hydrophobicity Formed by Water Molecules Embedded into Carboxyl-Terminated Self-Assembled Monolayers

2:20-2:40: Salma Falah Toosi, Sona Moradi, Narges Hadjesfandiari, Jayachandran N. Kizhakkedathu, and Savvas G. Hatzikiriakos; Department of Chemical and Biological Engineering, The University of British Columbia, Vancouver BC, V6T 1Z3, CANADA; The Effect of Superhydrophobicity on the Bacterial Adhesion on Polymeric Surfaces

2:40-3:00: Keun Park and Hyun-Joong Lee; Department of Mechanical System Design Engineering, Seoul National University of Science and Technology, Seoul, KOREA; Development of Superhydrophobic/Hydrophilic Hybrid Surface by Selective Micropatterning and Electron Beam Irradiation

REGISTRATION INFORMATION

DATES:

JULY 13-15, 2016: TENTH
INTERNATIONAL SYMPOSIUM ON
CONTACT ANGLE, WETTABILITY AND
ADHESION

www.mstconf.com/Contact10.htm

LOCATION:

Babbio Center Room 122 (1st Floor)
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www.mstconf.com/Stevens_3D_campus_map.pdf

REGISTRATION:

Speaker/student \$395 each; regular
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The following hotels are recommended in
order of proximity to the university:

W HOBOKEN

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Phone: (201) 253-2400
WEB: www.whoboken.com

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10018
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Address: 481 8th Ave, New York, NY
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WEB: www.wyndham.com

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ON CAMPUS HOUSING

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www.mstconf.com/StevensOnCampusHousing.pdf

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You will find the following information
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- ! Hotel Information
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CANCELLATIONS: Registration fees are
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REGISTRATION FORM: CHECK ALL THAT YOU WANT TO ATTEND

TENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION, July 13-15, 2016 (speaker/student)	\$395
TENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION, July 13-15, 2016 (regular attendee)	\$695
Short Course on <u>Applied Adhesion Measurement Methods</u> (July 16, 2016)	\$695
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⁶ As a further security measure card companies require the billing address on the credit card. The main items are the street address and zip code.