

# MATERIALS SCIENCE AND TECHNOLOGY NEWSLETTER

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## TO SEE A SURFACE THROUGH A DROP OF WATER

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## EDITORIAL COMMENTS

We would like to remind all readers of the Newsletter of the upcoming EIGHTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION to be held at Université Laval, Québec City, Québec, Canada; June 13-15, 2012. Judging by the broad range of topics covered in the program, attached at the end of this letter, it is apparent that the contact angle technique is indeed a magical window into the surface properties of the material world. A quick sampling of the program will illustrate this supposition:

### Superhydrophobic/hydrophilic Behavior

The topic of superhydrophobic/superhydrophilic behavior is under very active investigation by many research groups worldwide as illustrated by the 9 papers submitted to the symposium. Applications range from self cleaning surfaces to preventing ice buildup on power lines. A most interesting paper has been submitted by Dr. Picraux from the Los Alamos National Laboratory entitled "Design of Nanowire Surfaces with Photo-induced Superhydrophilic to Superhydrophobic Switching". The authors claim that they have developed functionalized photochromic monolayers for which the wetting angle of liquids can be reversibly switched optically by more than 100 degrees between superhydrophilic and superhydrophobic states. One would imagine that there would be tremendous applications for this technology in the realm of hand held tablets which are so tremendously popular these days.

### Fundamental Studies

As always understanding wetting behavior at the molecular and microscopic level is critical to the development of new technologies based on wetting behavior as well as promoting our basic understanding of molecular interactions. Much work is going on in particular to study the effect of surface texture on contact angle behavior. The paper by Dr. Ri Li on "Wetting of Contact Line on Textured Hydrophobic Surfaces" is an interesting example. This work purports to show that interactions at the contact line rather than the total contact area determine the contact angle.

### Behavior of Water and Ice

During the week of January 5-10, 1998 a severe ice storm ravaged Southeastern Canada. The total water equivalent of precipitation, comprising mostly freezing rain and ice pellets and a bit of snow, exceeded 85 mm in Ottawa, 73 mm in Kingston,

108 in Cornwall and 100 mm in Montreal. Further details of this horrific storm have been covered in a [previous newsletter \(www.mstconf.com/Vol5No1-2008.pdf\)](http://www.mstconf.com/Vol5No1-2008.pdf). The prolonged freezing rain brought down millions of trees, 120,000 km of power lines and telephone cables, 130 major transmission towers each worth \$100,000 and about 30,000 wooden utility poles costing \$3000 each. Consequences for the local population were predictably disastrous with about 900,000 households without power in Quebec; 100,000 in Ontario. It is of little surprise then that the surface interactions of freezing water and aluminum power cables is of considerable interest to the Canadian government and of little surprise also that contact angle measurements are playing a significant role in the effort to understand and control these interactions. Thus no fewer than 4 papers are dedicated to this problem.

### Novel Applications

It seems that hardly a day goes by but some new application of the contact angle behavior of surfaces arises apparently from nowhere. In fact, Carl Clegg of the ramé-hart instrument company has listed 50 different uses of the contact angle method ranging from the authentication of rare coins to the improved biocompatibility of polymer-based medical devices. For details see:

[www.ramehart.com/newsletters/2010-12\\_news.htm](http://www.ramehart.com/newsletters/2010-12_news.htm).

Adding to this we see in the program the paper by Dr. Daryl Williams entitled "The Surface Energy of Pharmaceutical Solids- Its Importance in Solids Processing" which now adds pharmaceutical processing to the already extensive list. Undoubtedly even more unsuspected applications will surface during the symposium.

### Oil Recovery and Mining Applications

The world's insatiable thirst for fossil fuel products has lead to the quest to recover oil from progressively less productive sources such as tar sands and heretofore depleted wells. A moments reflection makes it clear that surface interactions between the residual oil and the surrounding rock are what dominates the problem of separating the oil from the rock. Again contact angle measurements are one of the leading methods being used to understand this problem.

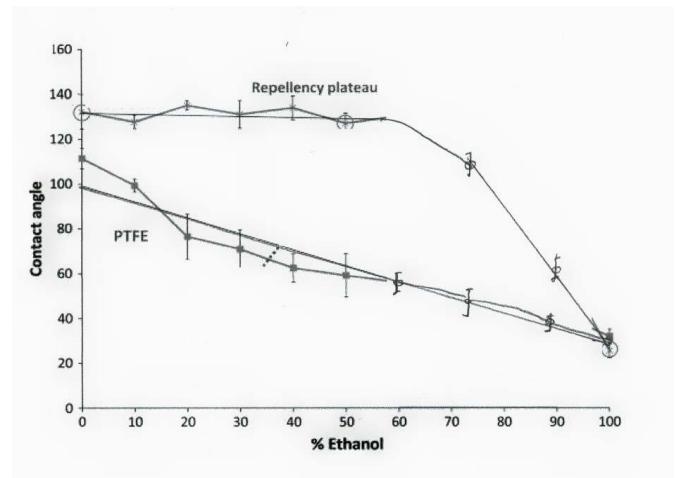
## Contact Angle in Micro and Nano Technology

The contact angle method is making remarkable inroads into the field of micro and nano technology mainly through the advent of micro-fluidics and micro-patterning of surfaces to control their wetting behavior. In the past I was always amazed at the very significant interest of Mechanical Engineering departments in the contact angle method. Being of the old school I always associated mechanical engineering with roads, bridges, automobiles, aircraft ... etc. A moments reflection, however, quickly reveals that fluid flow is also an important mechanical engineering problem and that this problem is beginning to shift toward the micro-fluidics problem of flow in very small channels a micron or less in diameter. At this scale gravity is all but irrelevant and it is surface forces, governed by van der Waals interactions, that dominate. Again the contact angle technique is one of the most useful tools in investigating this behavior. Added to this the extensive efforts now underway in patterning surfaces to control their wetting behavior is bringing the contact angle method to the forefront in the realm of micro and nano technology. The paper of Dr. Mikael Järn of the YKI, Institute for Surface entitled "Wettability Studies of Selectively Functionalized Nanopatterned Surfaces" is a prime example of this new and exciting development in surface science.

## Applications to Wood Science and Technology

Wood and wood products have been a mainstay of mankind since even before the dawn of civilization. Needless to say wood and wood products are still very much with us due to their ubiquity, unique properties and general availability as a relatively cheap and renewable resource. What is perhaps not so obvious is the many new and varied applications that wood is being put to by varying its surface properties through the use of plasma modification. Not surprisingly the contact angle method again comes into the picture in order to characterize the new surface properties. The paper of Dr. B. Riedl of Université Laval entitled "Influence of Atmospheric Pressure Plasma on North-American Wood Surfaces", highlights this trend nicely.

Finally, the use of contact angle measurements to study the amazing behavior of bacterial colonies is the subject of this issue's editorial essay.



**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.

## VIEWING MICROBES THROUGH A DROP OF WATER

A recent paper in the Proceedings of the National Academy of Sciences (PNAS)<sup>1</sup> adds yet another remarkable and intriguing example to the list of applications of the contact angle method. 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 environments<sup>2</sup>. Biofilm formation is now known to cause contamination of*

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<sup>1</sup> 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.

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

*plumbing, oil wells, medical implants, building heating, ventilation, air conditioning and other systems<sup>3</sup> 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<sup>4 5</sup>.*

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

FINAL PROGRAM EIGHTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION ; To be held at Université Laval, Québec City, Québec, CANADA, June 13-15, 2012

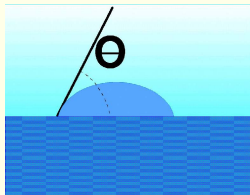
Below is the final program for the upcoming eighth in the CONTACT ANGLE symposium series. The Conference Director Dr. Mittal and I cordially invite all readers of the newsletter to join us in Québec to hear from leading investigators world wide what the latest developments are in this most remarkable and exciting field.

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<sup>3</sup>Costerton 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.

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

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



FINAL PROGRAM

EIGHTH INTERNATIONAL  
SYMPOSIUM ON

## CONTACT ANGLE, WETTABILITY AND ADHESION

To be held at Université Laval,  
Québec City, Québec, CANADA  
June 13-15, 2012



### SYMPOSIUM HISTORY AND MOTIVATION

In his opening remarks at the first symposium in this series Professor Robert Good pointed out that Galileo in the 17<sup>th</sup> 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.

### AUDIENCE AND PARTICIPATION

The primary focus of this symposium is to provide a forum for the discussion of cutting edge advancements in the field and to review and consolidate the accomplishments which have been achieved thus far.



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Contact by phone: 845-897-1654;  
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Full conference details and  
registration via the Internet will be  
maintained on our web site:

[www.mstconf.com/contact8.htm](http://www.mstconf.com/contact8.htm)



## SPONSORING ORGANIZATIONS

We are pleased to acknowledge the support of Université Laval and FPIinnovations for their generous support and organizational efforts for this symposium.

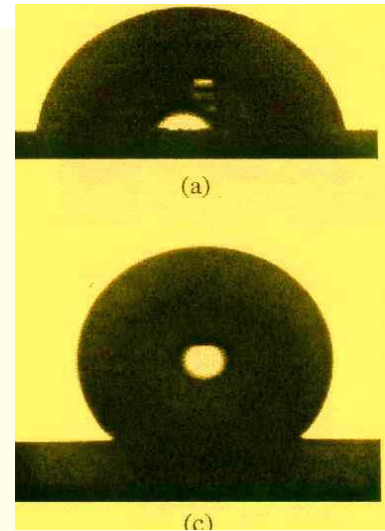
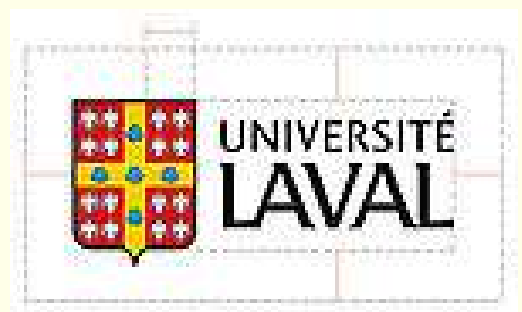
## ORGANIZERS AND CONTACT INFORMATION:

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While in Québec you can also plan to explore the many attractions of Québec City including whale watching at the Saguenay St Lawrence Marine Park. Complete details at: [http://www.parcmarin.qc.ca/1508\\_an.htm](http://www.parcmarin.qc.ca/1508_an.htm)

SESSION I: WEDNESDAY JUNE 13,  
2012; FUNDAMENTALS

8:00-8:05: INTRODUCTORY REMARKS

8:05-8:35: Edward Bormashenko;  
Head of the Laboratory of Polymers, Ariel  
University Center of Samaria, P.O.B. 3,  
Ariel 40700, ISRAEL; Physics of  
Wetting Transitions

8:35-9:05: Michael Nosonovsky;  
College of Engineering & Applied Science;  
University of Wisconsin-Milwaukee,  
Milwaukee, WI 53211; Contact Angle  
Hysteresis and Wetting Transitions in  
Underwater Oleophobic Metallic  
Surfaces

9:05-9:35: StÈphane Douezan, Randa  
Naouar, Silvie Dufour,  
Damien Cuvelier and Francoise Brochard-  
Wyart; Lab. PCC-UMR168, Institute Marie  
Curie, F-75231 Paris Cedex 05, FRANCE;  
Wetting Transition of Living Drops

9:35-10:05: Rafael Tadmor; Dan F.  
Smith Dept. of Chemical Engineering,  
Lamar University, P. O. Box 10053  
Beaumont TX 77710; Approaches in  
Wetting Phenomena

10:05-10:35: D. Seveno , J. Conti and J.  
De Coninck; Laboratory of Surface and  
Interfacial Physics, University of Mons,  
Place du Parc , 20, 7000 Mons, BELGIUM;  
Which Is the Best Wetting Theory?

10:35-1055: COFFEE BREAK

10:55-11:25: Ateeque Malani, Miguel  
Amat, Anilkumar Raghavanpillai, Ernest  
Wysong and Gregory Rutledge;  
Department of Chemical Engineering,  
Massachusetts Institute of Technology,  
Cambridge, MA; Molecular Modeling of  
Three Phase Contact for Static and  
Dynamic Contact Angle Phenomena

11:25-11:55: A. M. Emelyanenko and  
L. B. Boinovich; Russian Academy of  
Sciences, A.N. Frumkin Institute of Physical  
Chemistry and Electrochemistry, 31  
Leninsky prospect, 119991 Moscow,  
RUSSIA; The Analysis of Wettability as  
an Effective Tool to Study the  
Physico-chemical Processes at  
Interfaces

11:55-12-25: Angela Duparré;  
Fraunhofer Institute for Applied Optics &  
Precision Engineering, Optical Systems  
Department, Head Surface  
Characterization Group,  
Albert-Einstein-StraÙe 7, D-07745 Jena,  
GERMANY; Assessment Criteria for  
(Super)hydrophobic Surfaces with  
Stochastic Roughness

12:25-1:30: LUNCH BREAK

SESSION II: WEDNESDAY, JUNE 13,  
2012; SUPERHYDROPHOBIC/  
HYDROPHILIC BEHAVIOR

1:30-2:00: S. T. Picraux , Dongqing  
Yang , S. G. Choi , P. Aella , Antonio A.  
Garcia; Center for Integrated  
Nanotechnologies, Los Alamos National  
Laboratory, Los Alamos, New Mexico  
87545; Design of Nanowire Surfaces  
with Photo-induced Superhydrophilic  
to Superhydrophobic Switching

2:00-2:30: Md. A. Rahman, and  
Anthony M Jacobi ; Department of  
Mechanical Science and Engineering,  
University of Illinois at Urbana-Champaign,  
Urbana, IL 61801; Wetting Anisotropy  
on Brass Surfaces With Parallel  
Microgrooves

2:30-3:00: Masao Iwamatsu;  
Department of Physics, Tokyo City  
University, Setagaya-ku, Tokyo 158-8557,  
JAPAN; Heterogeneous Nucleation on  
a Completely Wettable Substrate

3:00-3:30: Pierre Letellier and Mireille Turmine; Laboratoire Interfaces et Systèmes Electrochimiques, CNRS, UPR15 LISE, Université Pierre et Marie Curie Paris 6, Case 133, 4 place Jussieu, 75252 Paris Cedex 05, FRANCE; Bubble Wettability and Solubility: non Extensive Thermodynamics Approach

3:30-4:00: Beatrice White, Zi-Jun Wang and Anne Kietzig; Department of Chemical Engineering, McGill University, Montreal; CANADA; Water Harvesting on Surfaces with Defined Hydrophobic-Hydrophilic Patterns

#### 4:00-4:20: COFFEE BREAK

4:20-4:40: Ri Li and Yanguang Shan; School of Engineering, University of British Columbia, Okanagan Campus, CANADA; Wetting of Contact Line on Textured Hydrophobic Surfaces

4:40-5:00: Edward Bormashenko; Head of the Laboratory of Polymers, Ariel University Center of Samaria, P.O.B. 3, Ariel 40700, ISRAEL; Novel Investigations of Liquid Marbles

5:00-5:20: Mikael Järn, Qian Xu and Mika Lindén; YKI, Institute for Surface Chemistry, Drottning Kristinas väg 45, SE-114 86, Stockholm, SWEDEN; Wettability Studies of Selectively Functionalized Nanopatterned Surfaces

5:20-5:40: Hong Zhao, Kock-Yee Law and Kyoo-Chul Park; Xerox Corporation, 800 Phillips Road, W147-59B, Webster, NY 14580; Effect of Surface Texturing on Repellency and Wetting Hysteresis of Superoleophobic Surfaces

5:40-6:00: Edward Bormashenko and Roman Grynyov; Ariel University Center of Samaria, Physics Faculty, 40700, P.O.B. 3, Ariel, ISRAEL; Plasma Treatment Modification of Surfaces of Biological Objects

6:00-6:20: Muhammad Osman and Roger A. Sauer; Aachen Institute for Advanced Study in Computational Engineering Science (AICES), RWTH Aachen University, Aachen, GERMANY; Computational Aspects of Self-Cleaning Surface Mechanisms

6:20-6:40: Chunlei Wang and Haiping Fang; Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Jialuo Road 2019, Jiading Shanghai, Shanghai 201800, CHINA; Effect of Ordered/Disordered Water on the Wetting Behavior Based on Molecular Dynamics Simulation

#### SESSION III: THURSDAY, JUNE 14, 2012; NOVEL INVESTIGATIONS AND APPLICATIONS

8:00-8:30: P.G. Rouxhet, M.J. Genet, J. Landoulsi, S. Fleith, V.G. Baldovino, F.A. Denis, S. Derclaye and Y. Adriaensen; Institute of Condensed Matter and Nanosciences, Université Catholique de Louvain, Croix du Sud 1 / Box L7.04.01, B-1348 Louvain-la-Neuve, BELGIUM; How Clean Is a Cleaned Surface? Contact Angle Measurements vs Surface Chemical Analysis

8:30-9:00: Luca Mazzola; University "Roma Tre", Italy, Dipartimento di Ingegneria Meccanica e Industriale, Mechanical and Industrial Engineering Department, Via della Vasca Navale 79 - 00146 Rome, ITALY; Determination of the Surface Free Energy at Nanoscale via Atomic Force Microscopy Without Altering the Original Morphology



9:00-9:30: Daryl R. Williams; Surfaces and Particle Engineering Laboratory, Department of Chemical Engineering, Imperial College London, South Kensington Campus, London, SW7 2AZ, U.K.; The Surface Energy of Pharmaceutical Solids- Its Importance in Solids Processing

9:30-10:00: A. A. Kafi and B. L. Fox; Composite Research Group, Centre for Materials and Fibre Innovation, Deakin University Geelong Victoria 3217, AUSTRALIA; Mapping the Surface Properties of PAN based Carbon Fibres

#### 10:00-10:20: COFFEE BREAK

10:20-10:50: Athanassia Athanassiou, Francesca Villafiorita-Monteleone, Claudio Canale, Elisa Mele, Silvia Dante, P. Davide Cozzoli, Dario Pisignano, Despina Fragouli and Roberto Cingolani; Istituto Italiano di Tecnologia (IIT), Genova, ITALY; Polymers/TiO<sub>2</sub> Nanorods Nanocomposites with UV-Enhanced Wettability for Novel Applications: from Microfluidic Systems to Selective Cell Growth

10:50-11:20: I. Mira, A. Swerin, M.A. Javed, M. Järn and K. Johansson; YKI, Institute for Surface Chemistry, P.O. Box 5607, SE-11486 Stockholm, SWEDEN; Surface Modifications at YKI for Improved Water and Ice Repellence

11:20-11:50: Jin Gyu Kim, Ilbeom Choi and Dai Gil Lee; School of Mechanical Aerospace & Systems Engineering, Korea Advanced Institute of Science and Technology, ME3221, Guseong-dong, Yuseong-gu, Daejeon 305-701, REPUBLIC OF KOREA; Contact Angle and Wettability of Hybrid Surface Treated Metal Adherends

11:50-12:20: Yu Zheng and Dandina N. Rao; Craft & Hawkins Department of Petroleum, Engineering, Louisiana State University, Baton Rouge, LA 70803; Dependence of Wettability, Spreading and Adhesion on Brine Salinity and Composition in Gas-Condensate Reservoirs

#### 12:20-1:30: LUNCH BREAK

### SESSION IV: THURSDAY JUNE 14, 2012; MISC. APPLICATIONS

1:30-2:00: Andrei S. Zelenev; CESI Chemical, a Flotek Company, 8701 New Trails Dr., Suite110, The Woodlands, TX 77381; Characterization of Mineral Rocks from Oil and Gas Reservoirs with Respect to Their Wettability and Surface Free Energy

2:00-2:20: Golrokh Heydari, Mikael Järn and Per M. Claesson; Department of Chemistry, Surface and Corrosion Science, Royal Institute of Technology, SE-100 44 Stockholm, SWEDEN; Measurement of Contact Angle at Sub-zero Temperatures and Implication for Ice Formation

2:20-2:40: Philseok Kim, Tak-Sing Wong, Jack Alvarenga, Michael J. Kreder and Joanna Aizenberg; Wyss Institute for Biologically Inspired Engineering, Harvard University, Cambridge, MA; Slippery Icephobic Coatings on Aluminum

2:40-3:00: Jorge Lehr and Anne Kietzig; Department of Chemical Engineering, McGill University, Montreal, CANADA; Adjustable Surface Wettability of Metallic Surfaces by Femtosecond Laser Irradiation

3:00-3:20: Chang Seon Bang, Jin Gyu Kim and Dai Gil Lee; Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology, ME3221, Guseong-dong, Yuseong-gu, Daejeon 305-701, REPUBLIC OF KOREA; Role of Contact Angle in the Performance Improvement of Adhesively Bonded Metal Joints at Cryogenic Temperatures

3:20-3:40: Q.V. Bui, K.S. Kim and S.B. Jung; School of Advanced Materials Science and Engineering, Sungkyunkwan University, 300 Cheoncheon - Dong, Jangan - Gu, Suwon 440-746, KOREA; Wettability, Interfacial Reaction and Ball Shear Strength of Sn-1.0Ag-XCe Solders on ENIG Surface Finish

### 3:40-4:00: COFFEE BREAK

4:00-4:20: Kwang-Seok Kim, Quoc Vu Bui, Yongil Kim, Yong-Ho Choa and Seung-Boo Jung; SKKU Advanced Institute of Nanotechnology (SAINT), Sungkyunkwan University, Suwon, 440-746, Republic of KOREA; Contact Angle Analysis on the Printed Pattern Shapes Controlled by Viscosity of Cu Nanopaste

4:20-4:40: Emil Chibowski, Konrad Terpilowski and Lucyna Holysz; Department of Physical Chemistry- Interfacial Phenomena Faculty of Chemistry, Maria Curie-Sklodowska University, 20-031 Lublin, POLAND; Effect of Relative Humidity on Contact Angle and its Hysteresis on Phospholipid DPPC Bilayer Deposited on Glass

4:40-5:00: Miguel Gómez, Enric Bertran and Ricardo Molina; Chemical and Biomolecular Nanotechnology Department, Institute of Advanced Chemistry of Catalonia (IQAC), Consejo Superior de Investigaciones Científicas (CSIC), Jordi Girona 18-26, 08034 Barcelona SPAIN; Hydrophilic-Oleophobic Coatings by Plasma Assisted Polymerization in Liquid Phase and Fluorosurfactant Complexation

5:00-5:20: L. Ziyani, V. Gaudefroy, V. Ferber and F. Hammoum; PRES LUNAM Ifsttar, Route de Bouaye, CS4, 44344 Bouguenais Cedex, FRANCE; Wettability of Mineral Surfaces by Bituminous Binders: Applications to Road Industry

5:20-5:40: G.C. Pirlot, O. Debaisieux, A. Goedel, A. Lacroix, B. Nysten and P. G. Rouxhet; Institute of Condensed Matter and Nanosciences, Université catholique de Louvain, Croix du Sud 1 / Box L7.04.01, B-1348 Louvain-la-Neuve, BELGIUM; Aluminum Adherence to Polypropylene Films Used for Food Packaging : Input and Limitation of Contact Angle Measurements

### SESSION V: FRIDAY, JUNE 15, 2012: SUPERHYDROPHOBICITY

8:00-8:30: Stefan Seeger; Universität Zürich, Physikalisch-Chemisches Institut, Winterthurerstrasse 190. 8057 Zürich, SWITZERLAND; Wettability Behavior and Surface Characterization of Various Materials, Subtopic: Superhydrophobicity

8:30-9:00: Athanasia Athanassiou, Athanasios Milionis, Luigi Martiradonna, George C. Anyfantis, Ilker S. Bayer and Despina Fragouli; Istituto Italiano di Tecnologia (IIT), Via Morego 30, 16163, Genova, ITALY; Control of the Water Wettability and Adhesion on Micropillars Using Combined Geometrical and Chemical Surface Design

9:00-9:30: L.B. Boinovich, and A.M. Emelyanenko; Russian Academy of Sciences, A.N. Frumkin Institute of Physical Chemistry and Electrochemistry, 31 Leninsky prospect, 119991 Moscow, RUSSIA; The Mechanisms of Anti-icing Resistance of Superhydrophobic Surfaces

9:30-10:00: Chang-Hwan Choi; Department of Mechanical Engineering, Stevens Institute of Technology, Hoboken, New Jersey; Ice Adhesion on Superhydrophobic Surfaces

#### 10:00-10:20: COFFEE BREAK

10:20-10:40: Wei Xu and Chang-Hwan Choi; Department of Mechanical Engineering, Stevens Institute of Technology; Is a Superhydrophobic Surface Really Slippery?: a New Criterion to Determine the Stickiness of Superhydrophobic Surfaces

10:40-11:00: Peichun Amy Tsai; Complex Fluids Group, Dept. Mechanical & Aerospace Engineering, Princeton University, Princeton, NJ; Evaporation and Impact of Water Droplet on Superhydrophobic Surfaces

11:00-11:30: Zong-Han Yang, Fan-Ching Chien, Chiung-Wen Kuo, Di-Yen Chue, and Peilin Chen; Center for Applied Sciences, Academia Sinica, 128, Section 2, Academia Road, Nankang, Taipei 115, TAIWAN; Interfacial Adhesion of Superhydrophobic Surfaces with Pillar-like Hierarchical Structures

11:30-12:00: Thomas Bahners, Lutz Prager and Jochen S. Gutmann; Deutsches Textilforschungszentrum Nord-West e.V., Adlerstr. 1, 47798 Krefeld, GERMANY; Super-hydrophilic Surfaces by Photo-induced Micro-Folding

12:00-12:20: Luisa Coriand, Angela Duparré, and Andreas Tünnermann; Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Strasse 7, 07745 Jena, GERMANY; Investigation of Hydrophilic Optical Coatings with Anti-Fog Behavior

#### 12:20-1:30: LUNCH BREAK

#### SESSION VI: FRIDAY, JUNE 15, 2012; WOOD PRODUCT TECHNOLOGY

1:30-1:50: Herbert P. Jennissen, Steffen Lüers and Markus Laub; Institute of Physiological Chemistry, University of Duisburg-Essen, Hufelandstr. 55, D-45122 Essen, GERMANY; Defining and Quantitating Superhydrophilicity

1:50-2:20: B. Riedl, C. Anghel, P. Blanchet and V. Blanchard; Département Des Sciences du Bois et De La Forêt, Université Laval, Québec, QC, CANADA; Influence of Atmospheric Pressure Plasma on North-American Wood Surfaces

2:20-2:40: Bouddah Poaty Bernard Riedl, Pierre Blanchet Vincent Blanchard, and Luc Stafford; Centre de Recherche sur le Bois, Pavillon G.-H. Kruger, Université Laval, Québec (QC), G1V 0A6, CANADA; Improved Water-Repellency of Black Spruce Wood Surfaces after Treatment In Carbon Tetrafluoride Plasmas

2:40-3:10: M. Petric, A. Kutnar, L. Rautkari, K. Laine and M. Hughes; University of Ljubljana, Biotechnical Faculty, Department of Wood Science & Technology, Ljubljana, SLOVENIA; Dynamic Wettability Behaviour of Wood Modified by Surface Densification

3:10-3:30: Luc Stafford; Department of Physics, University of Montreal, Montreal, Quebec H3C 3J7, CANADA; Grafting Dynamics of Hydrophobic Functional Groups on Wood Surfaces Using Atmospheric-Pressure, Organosilicon-containing Plasmas

3:30-3:50: Fabio Tomczak and Bernard Riedl; Université Laval, Centre de Recherches sur le bois, Pavillon Gene-H.-Kruger, Quebec City, G1V0A6 QC, CANADA; ZnO Deposition on Wood by Plasma: the Effect on Wettability

3:50-4:10: COFFEE BREAK

4:10-4:30: Fabio Tomczak and Bernard Riedl; Université Laval, Centre de Recherche sur le bois, Pavillon Gene-H.-Kruger, Quebec City, G1V0A6 QC, CANADA; Wettability of Canadian Woods

4:30-4:50: Maziar Sedighi, Mikael Järn, Per M. Claesson, Magnus Wålinder and Agne Swerin; YKI, Ytkemiska Institutet AB/Institute for Surface Chemistry, Box 5607, SE-114 86 Stockholm, SWEDEN; Comparison of Different Methods for Studying Wood Wettability and Liquid Penetration

4:50-5:20: Niklas Nordgren, Petra Nordqvist, Farideh Khabbaz, Eva Malmström and Malin Bergenstråhle-Wohlert; YKI Institute for Surface Chemistry, Drottning Kristinas väg 45, Box 5607, SE-114 86 Stockholm, SWEDEN; A Multiscale Approach to Evaluate Bio-Adhesives for Wood

5:20: CONCLUDING REMARKS

## REGISTRATION INFORMATION DATES:

JUNE 13-15, 2012: EIGHTH  
INTERNATIONAL SYMPOSIUM ON  
CONTACT ANGLE, WETTABILITY AND  
ADHESION

[www.mstconf.com/contact8.htm](http://www.mstconf.com/contact8.htm)

### LOCATION:

Pavillon Gene-H.-Kruger  
GHK  
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### HOTEL AND ON CAMPUS

#### ACCOMMODATIONS:

The following is a list of hotels and  
residences reasonably close to the lecture  
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1) Recommended-best price/quality  
ratio-10 min walking distance:

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1200 DE GERMAIN-DES-PRÉS AVE  
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Québec  
(418) 658-1224  
[www.quebec.althotels.ca](http://www.quebec.althotels.ca)

2) Closest-5 min walking distance:

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Any hotel in the downtown is a 10 minute  
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Convenient residences are available on  
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## SHORT COURSES ON APPLIED ADHESION MEASUREMENT METHODS (June 11, 2012) AND DURABILITY OF ADHESIVE JOINTS (June 12, 2012) :

Associated with this symposium MST gives short courses on adhesion related topics. Since nearly all of the MST symposia have some relation to adhesion phenomena, the ability to quantify the adhesion of one material layer to another is clearly one of the unifying themes. These courses are designed to mesh with the topical symposia by presenting an overview of the most useful techniques for evaluation of the adhesion of coatings and the durability of adhesive joints. Emphasis is given to methods which can be carried out in a manufacturing environment as well as in the lab and which give results that are directly relevant to the durability and performance of coatings, adhesive joints and other bonded laminate structures. The effects of material elastic properties and residual stress are considered as well as environmental influences which affect coating adhesion and joint durability.

### OVERVIEW OF TOPICS COVERED IN ADHESION MEASUREMENT METHODS COURSE I INCLUDE:

1. Basics of adhesion measurement
2. Role of residual stress and material mechanical properties on adhesion
3. Problem of setting adhesion requirements for coating applications
4. Adhesion measurement at atomic and molecular level (fundamental adhesion)
5. Applications

### OVERVIEW OF TOPICS COVERED IN ADHESIVE JOINTS COURSE I INCLUDE:

1. Two Aspects of Adhesive Action
2. Durability of Adhesive Joints
3. Direct Measurement of Joint strength
4. Tests That Measure Practical Adhesion Between Adhesive and Adherend
5. Measuring Adhesive Thermal-Mechanical Properties

6. Role of Residual Stress
7. Nondestructive Inspection

Audience: Scientists and professional staff in R&D, manufacturing, processing, quality control/reliability involved with adhesion aspects of coatings or laminate structures.

Level: Beginner to Intermediate

Prerequisites: Elementary background in chemistry, physics or materials science.

Duration: 1 day

Registration fee: \$695: Includes course notes, handouts and a copy of the newly published handbook and reference volume: ADHESION MEASUREMENT METHODS: THEORY AND PRACTICE (CRC Press, 2006).

### HOW YOU WILL BENEFIT FROM THIS COURSE:

- ▶ Understand advantages and disadvantages of a range of adhesion measurement techniques.
- ▶ Gain insight into mechanics of adhesion testing and the role of intrinsic stress and material properties
- ▶ Learn optimal methods for setting adhesion strength requirements for coating applications.
- ▶ Learn how to select the best measurement technique for a given application.
- ▶ Gain perspective from detailed discussion of actual case studies of product manufacturing and development problems.

CANCELLATIONS: Registration fees are refundable, subject to a 15% service charge, if cancellation is made by May 20, 2012. NO refunds will be given after that date. All cancellations must be in writing. Substitutions from the same organization may be made at any time without penalty. MST Conferences reserves the right to cancel any of the symposia or the short course if it deems this necessary and will, in such event, make a full refund of the registration fee. No liability is assumed by MST Conferences for changes in program content.

**REGISTRATION FORM: CHECK ALL THAT YOU WANT TO ATTEND**

EIGHTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION, JUNE 13-15, 2012 (speaker/student)	\$395
EIGHTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION, JUNE 13-15, 2012 (regular attendee)	\$595
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Short Course on Durability of Adhesive Joints (June 11,2012)	\$695
Short Course on Applied Adhesion Measurement Methods (June 12,2012)	\$695
LATE FEE: Add \$100 to registration fee is registering after May 20, 2012	\$100
<b>TOTAL REGISTRATION FEE</b>	

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