

MATERIALS SCIENCE AND TECHNOLOGY NEWSLETTER

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SURFACE SCIENCE AND CONTACT ANGLE IN A FLAT WORLD

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Is the World Flat or Just Shrinking

In his recent best selling volume "The World Is Flat: a Brief History of the 21st Century"¹, New York Times foreign affairs columnist Thomas Friedman makes a case for the "flattening" of the planet where events in some specific locality have a wholly unexpected impact on widely remote locations. In addition, a convergence of technologies has allowed countries like China and India to become a part of the global supply chain for services and manufacturing creating an explosion of wealth and giving these countries a crucial stake in the ongoing process of "globalization" that did not exist as little as 30 years ago. An apparent consequence of this "flattening" or perhaps better stated "shrinking" process has been a heightening of international competition forcing many to run faster just to stay in place. It is almost as though the planet seems to be getting too small and running too fast for human populations to cope in a stable manner.

MST CONFERENCES has been as strongly affected by these events as much as any other organization large or small. The terrorist attack on the World Trade Towers in NY City in 2001 forced the only outright cancellation of MST symposia in the 11 year history of the conference series. This tragic event underlined the fact that social political unrest in the Middle East can have an enormous impact on the other side of the globe. In addition, social/political events are not the only phenomena that can have an unexpected influence far beyond local borders as was demonstrated by the SARS epidemic in the Spring of 2005. Early on it appeared that SARS was a viral outbreak confined to Hong Kong and other locations in South East Asia. Due to widespread air travel ,however, the infection rapidly spread over the globe and in particular to Toronto Canada which the World Health Organization (WHO) soon declared to be an epicenter of the infection. As bad luck would have it MST happened to have a symposium scheduled to be held in Toronto in June 2005 right at the peak of the outbreak. In this case there was time to move the location of the meeting avoiding outright cancellation but nevertheless incurring a nearly 30% decrease in attendance. If social political events and disease outbreaks are not enough, even geologic events conspire to join the plague of global catastrophes that spread their consequences over

vast areas. This was dramatically illustrated very recently by the Iceland volcano which shut down air traffic over nearly all Europe in April this year and thus prevented nearly all of the European participants in MST's International symposium on Surface Science Aspects of Pharmacology from attending the meeting which was held in Danbury, CT some 1000 miles or more away from the geologic event.

Surface Science and Emerging Global Technologies

Moving on from global catastrophes to the main topic of this newsletter which is the upcoming SEVENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION we find that, in its own quiet way, surface science technology and the contact angle measurement method are also having a global impact. In this regard we would like to draw the readers attention to the Ramé-Hart newsletter of March 2010 edited by our colleague and good friend Carl Cleg who is also one of the corporate sponsors of the contact angle symposium coming up in June 23-25 this year. Entitled "Surface Science and the Green Revolution"² the newsletter highlights the remarkable range of energy related technologies that are critically dependent on surface science technologies and thus directly or indirectly influenced by contact angle phenomena. The following is a quick summary of the now emerging technologies covered in the newsletter:

- ▶ **WIND TURBINES:** Ice buildup, erosion by sand and other abrasive particulates and also splatter by impacting insects can foul the turbine blades and lower efficiency by as much as 50%. Contact angle measurements are playing an important role in characterizing the surface behavior of the blades in an effort to optimize self-cleaning, anti-stick, and anti-icing properties.
- ▶ **SOLAR CELLS:** As with the turbine blades mentioned above contact angle measurements are being used to develop new protective coatings that minimize contaminant buildup and promote self cleaning properties which lead to greater efficiency and lower maintenance costs.
- ▶ **NUCLEAR POWER:** Surprisingly enough contact angle measurements and surface energetics are helping reactor designers to

¹ "The World is Flat: A Brief History of the Twenty-first Century", Thomas L. Friedman (Ferrar, Straus and Giroux, New York, 2005)

² The reader can get the full story by going directly to the Ramé-Hart web site at: (www.ramehart.com/newsletters/2010-03_news.htm)

develop coatings which help overcome the problem with radioactive waste by recycling spent nuclear fuel and producing less toxic byproducts. In addition contact angle and wetting behavior studies are being carried out on the working fluids and vapors which cool and transfer energy in the reactor in order to develop safer and more reliable 3rd generation power plants.

- ▶ **ELECTRIC AUTOMOBILES:** An emerging power option for future electric vehicles will be a battery built out of an array of thin laminated Lithium Ion cells sealed in a flat enclosure that mounts under the seat. Contact angle and wettability measurements are playing a critical role in the design of porous electrodes using plasma-modified polyethylene and micro-porous gel polymers as separators in these batteries.

These are a few of the topics covered in the newsletter and we encourage the reader interested in more details to go to the Ramé-Hart webpage².

PRELIMINARY PROGRAM

SEVENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION; To be held in Danbury, Connecticut, USA, June 23-25, 2010

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 will be 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 will be of prime concern.

In addition, a host of applications of the contact angle technique will be explored including but not limited to: wettability of powders, fibers, wood products, papers, polymers and monolayers. Further focus will be 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. The primary focus of this symposium will be 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. The following is a preliminary list of papers to be presented.

MEASUREMENT METHODS

S. F. Chini and **A. Amirfazli**; Department of Mechanical Engineering, University of Alberta, Edmonton, AB, CANADA T6G 2G8; **A New Method for Measuring the Contact Angle of Asymmetric and Symmetric Drops**

Andrew J. B. Milne and **Alidad Amirfazli**; Department of Mechanical Engineering, University of Alberta, Edmonton, AB, CANADA; **Drop Adhesion to Surfaces Exposed to a Shearing Airflow**

Thomas Bahners; Deutsches Textilforschungszentrum Nord-West e. V., Institut an der Universität Duisburg-Essen Adlerstraße 1, 47798 Krefeld, GERMANY; **The "Do's" and "Donts" of Wettability Characterization in Textiles**

Javier Montes Ruiz-Cabello, Felipe II Guerrero-Barba, Miguel A. Rodríguez-Valverde and **Miguel A. Cabrerizo-Vílchez**; Biocolloid and Fluid Physics Group, Department of Applied Physics, University of Granada, Granada SPAIN; **A New Strategy to Predict the Equilibrium Contact Angle of Rough Homogeneous Surfaces from Contact Angle Hysteresis Measurements**

Shreerang S. Chhatre, Jesus O. Guardado, Joseph M. Mabry, Gareth H. McKinley, and Robert E. Cohen; Department of Chemical Engineering Massachusetts Institute of Technology, Cambridge, MA 02139; **Girifalco – Good Analysis on Perfluorinated SiO_x Surfaces**

Sonja Richter, Chong Li, Francois Ayello, Xuanping Tang, Win Robbins, Srdjan Nestic; Institute for Corrosion and Multiphase Technology, Department of Chemical Engineering, Ohio University, Athens, OH ; **Contact Angle Measurements for the Assessment of Corrosion Issues in Carbon Steel Pipelines Carrying Crude Oil.**

SUPERHYDROPHOBIC EFFECT

Wei Xu, Rajesh Leeladhar, and **Chang-Hwan Choi**; Department of Mechanical Engineering, Stevens Institute of Technology, Hoboken NJ; **Effects of Micro and Nano Particles on Wetting Dynamics of Evaporating Droplets on Superhydrophobic Surfaces**

Lutz Prager, Thomas Bahners; Leibniz-Institut für Oberflächenmodifizierung;; **Creating Superhydrophilic Surfaces by Photo-induced Microfolding**

Jonathan Rothstein; Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA 01003; **Drag Reduction Using Superhydrophobic Surfaces**

Tamir Stein; Ariel University Center of Samaria, Department of Chemical Engineering and Materials. Bar-Ilan University, Chemistry Department; **Electrostatically Driven Droplets Deposited on Superhydrophobic Surfaces**

CONTACT ANGLE FOR SURFACE CHARACTERIZATION

Costin Anghel and Bernard Riedl; Wood Science Department, Laval University, Sainte-Foy, Quebec G1K 7P4, CANADA; **Contact Angle Measurements for Monitoring Influence of Atmospheric Pressure Plasma on Wood Surfaces**

Y.L. Chow, C.K. Chan and C.W. Kan; Institute of Textile and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, HONG KONG; **A Study of Grey Cotton Fabric Using Laser Technology and Contact Angle Goniometry**

A. A. Hamouda, University of Stavanger, P. O. Box 8002 Ullandhaug, 4068 Stavanger, NORWAY; **Wettability Alteration of Sand Stone by Nitrogen Based Component and its Effect on the Interfacial Charge Between Asphaltic Model Oil and Sulfate and Magnesium Ions**

Halim Kusumaatmaja; MPI of Colloids and Interfaces, Am Mühlenberg 2, D-14476, Golm/Potsdam, GERMANY; **Wetting on Membranes**

Y.L. Lam, C.W. Kan, C.W.M. Yuen and C.H. Chui; Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, CHINA; **Surface Physical and Chemical Analysis of Plasma-treated Cotton Fabric Subjected to Wrinkle-resistant Finishing**

Marko Petrič and Milan Šernek; University of Ljubljana, Biotechnical Faculty, Department of Wood Science & Technology, amnikarjeva 101, SI-1000 Ljubljana, SLOVENIA; **Contact Angle Measurements on Wood And Calculation of Its Surface Free Energy**

L. Mazzola, M. Sebastiani, E. Bemporad and F. Carassiti; Mechanical and Industrial Engineering Department, University "Roma Tre", Rome, ITALY; **An Innovative non Contact Method to Measure Surface Free Energy on Micro Areas**

Carmen L. Moraila-Martínez, Ramón Pericet-Cámara, **Miguel A. Rodríguez-Valverde** and Miguel A. Cabrerizo-Vílchez; Biocolloid and Fluid Physics Group, Department of Applied Physics, University of Granada, Granada SPAIN; **Kinetic Contact Angle Hysteresis of Titanium Surfaces**

CONTACT ANGLE FOR ADVANCED MATERIALS DEVELOPMENT

Laurence Boulangé and Flora Sterczynski; EIFFAGE Travaux Publics, Centre d'Etudes et de Recherches de Corbas, FRANCE; **Physico Chemical Study of Environment-friendly Emulsifiers for the Road Industry Using Drop Shape Analysis**

Yu Fu and W. H. Zhong; School of Mechanical and Materials Engineering, Washington State University, Pullman, WA 99164; **Effects of Nano-additives on Dynamic Wetting Behavior and Flowability of Epoxy Resins**

Adam J. Meuler, Kyoo-Chul (Kenneth) Park, Joseph M. Mabry, Gareth H. McKinley, and Robert E. Cohen; Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139; **Towards Practical Omniphobic Coatings**

Masataka Murahara; Professor Emeritus of Tokai University, JAPAN; **Plasma Pre-treatment Effect for Photo-chemical Modification and Patterned Functional Group Substitution onto Low Wettable Materials**

Niklas Nordgren; Department of Fibre and Polymer Technology, Coating Technology, KTH Royal Institute of Technology, Teknikringen 56-58, SE-100 44 Stockholm, SWEDEN; **Tailored Interfacial Properties by Surface Grafting: From Tunable Biofiber Adhesion to Superhydrophobic Cellulose**

Andreas Wego and Thomas Bahners; Deutsches Textilforschungszentrum Nord-West e.V.;

Photochemical Functionalization of Carbon Fibers for Enhanced Matrix Adhesion

ADVANCED INVESTIGATIONS

Edward Bormashenko; Ariel University Center of Samaria, Applied Physics Faculty, Ariel, Israel, 40700, P.O.B. 3; **Novel Investigations of Liquid Marbles**

Augustin Karasangabo and Bernhard Christian; University of Leoben, Franz-Josef-Straße 18, A-8700 Leoben, AUSTRIA; **Investigation of the Nature of Liquid Steel – Alumina Interfacial Interactions from Sessile Drop Measurements: Cases of Fe-Ti and Fe-P Alloys**

Kyoo-Chul (Kenneth) Park, Shreerang S. Chhatre, Wonjae Choi, Robert E. Cohen, and Gareth H. McKinley; Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139; **Robustness Analysis of Non-Wetting Surfaces Based on Distorted Liquid-Air Interfaces of Droplets**

J. R. Moffat, K. Sefiane and **M. E. R. Shanahan**; Laboratoire de Mécanique Physique (LMP)-UMR CNRS 5469, Université Bordeaux 1, 351 Cours de la Libération, 33405 TALENCE Cedex, FRANCE; **Wetting Hysteresis as Induced by Liquid Nano Suspensions**

Rafael Tadmor, Prashant Bahadur, Aisha Leh, Hartmann E. N'guessan, Rajiv Jaini, Lan Dang and Dan F. Smith Department of Chemical Engineering, Lamar University, Beaumont TX 77710; **The Influence of Normal Force on the Lateral Force at the Interface Between a Liquid Drop and a Surface**

Peichun Amy Tsai, Christophe Pirat, Detlef Lohse, Alisia M. Peters, Rob Lammertink, Matthias Wessling, Sergio Pacheco and Leon Lefferts; Physics of Fluids Group, University of Twente, THE NETHERLANDS; **Wetting Transition, Drop Impact, and Micro-flows upon Hydrophobic Microstructures**

REGISTRATION, HOTEL AND TRAVEL INFORMATION

JUNE 23-25, 2010: SEVENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION
www.mstconf.com/contact7.htm

LOCATION:

DANBURY PLAZA
Hotel & Conference Center
18 Old Ridgebury Road
Danbury, CT 06810
Tel. 203-794-0600
FAX. 203-798-7735

E-mail: aweber@danburyplaza.com
Web Site: www.danburyplaza.com

Please make room reservations directly with the Danbury Plaza Hotel. Make your reservations early and be sure to mention that you are attending the MST symposium in order to receive the reduced conference hotel rate.

TRANSPORTATION: Limousine and shuttle service is available from Laganardia and Kennedy airports

Full details limousine, shuttle and car rental services from Laganardia and Kennedy airports are available at the conference web site at: www.mstconf.com/HotelTravelDanbury.htm

REGISTRATION: Full details on registration are available at the conference web site at:

www.mstconf.com/RegMST.htm or use the form given below which can be submitted to us by mail, FAX or over the phone at the numbers below. The form below can also be filled in and scanned into a graphic file and sent to (rhlacombe@compuserve.com) as an E-mail attachment. Please note that this method is somewhat less secure than the previous procedures but is nonetheless quite safe as compuserve.com is a secure server and all files relating to a registration are immediately downloaded and then purged from the system. We leave it to the participant to decide what method is best. Finally, though this is not encouraged, participants can register on site at the symposium. We do however require advanced notification so that we can plan accordingly.

SYMPOSIUM WEB PAGE: Further details on this symposium are available at: www.mstconf.com/contact7.htm

SHORT COURSE ON APPLIED ADHESION MEASUREMENT METHODS, JUNE 26, 2010:

Associated with this symposium MST gives a short course on adhesion measurement methods. 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. This course is designed to mesh with the topical symposia by presenting an

overview of the most useful adhesion measurement techniques which are being used to evaluate the **PRACTICAL ADHESION** of coatings. Emphasis will be 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 the coatings. The effects of material elastic properties and residual stress are considered as well as other external influences which affect coating adhesion.

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: \$595: 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.

These symposium is being organized under the direction of Dr. K. L. Mittal, Editor-in-Chief, Journal of Adhesion Science and Technology and by MST Conferences. All presenters will be invited to publish their work in the Journal of Adhesion Science and Technology.

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Full conference details and registration via the Internet will be maintained on our web site:

CANCELLATIONS: Registration fees are refundable, subject to a 15% service charge, if cancellation is made by June 15, 2010. **NO** refunds will be given after this 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

INTERNATIONAL SYMPOSIUM ON SURFACE SCIENCE ASPECTS OF PHARMACEUTICAL TECHNOLOGY, April 19-21, 2010 (speaker/student)	EXPIRED
INTERNATIONAL SYMPOSIUM ON SURFACE SCIENCE ASPECTS OF PHARMACEUTICAL TECHNOLOGY April 19-21, 2010 (regular attendee)	EXPIRED
SEVENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION, JUNE 23-25, 2010 (speaker/student)	\$395
SEVENTH INTERNATIONAL SYMPOSIUM ON CONTACT ANGLE, WETTABILITY AND ADHESION, JUNE 23-25, 2010 (regular attendee)	\$595
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Deduct additional 10% if more than 1 participant from same institution	
Short Course on Applied Adhesion Measurement Methods	\$595
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