

MATERIALS SCIENCE AND TECHNOLOGY NEWSLETTER

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SURFACE MODIFICATION, SILANES AND RELATED ISSUES

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EDITORIAL COMMENTS

It is our pleasure in this issue of the newsletter to announce several symposia coming up in 2009 and early 2010. The week of July 12, 2009 will be quite busy with the following two important meetings:

SEVENTH INTERNATIONAL SYMPOSIUM ON POLYMER SURFACE MODIFICATION: RELEVANCE TO ADHESION to be held July 12-15, 2009 at the University of Maine, Orono, Maine, USA.

SEVENTH INTERNATIONAL SYMPOSIUM ON SILANES AND OTHER ADHESION PROMOTERS to be held July 15-16, 2009 at the University of Maine, Orono, Maine, USA.

There is quite active interest in both of these meetings and details of the final programs are given below.

November will feature the upcoming:

SIXTH INTERNATIONAL SYMPOSIUM ON POLYIMIDES AND OTHER HIGH TEMPERATURE/HIGH PERFORMANCE POLYMERS: SYNTHESIS, CHARACTERIZATION AND APPLICATIONS; to be held November 9-11, 2009 at the Florida Institute of Technology, Melbourne, Florida, USA. The "Call for Papers" for this symposium is also listed below.

Finally in April 2010 we announce an entirely new symposium:

INTERNATIONAL SYMPOSIUM ON SURFACE SCIENCE ASPECTS OF PHARMACEUTICAL SCIENCE, PHARMACOLOGY, COSMETICS AND BIOTECHNOLOGY, To be held April 19-21, 2010, Danbury Connecticut, USA.

This symposium essentially arose out of our interactions with colleagues that normally participate in the SURFACE MODIFICATION or SILANE symposia. These individuals deal with problems of drug delivery systems, biological implants and adhesives for treating bone fractures. In addition to participating in the various MST symposia they also participate in strictly biomedical symposia where issues of surface science commonly arise. They point out that many of their colleagues from the biomedical community have only the most rudimentary knowledge of surface science issues and are thus hampered in much of their work where questions of surface interactions are important. It thus became apparent that a symposium devoted to the surface science aspects of biomedical technology could serve an important purpose in bridging the gap between the biotechnology and

surface science communities. The staff of MST have dealt with problems of surface science since the mid 1970s so we felt confident that we could furnish that piece of the puzzle. In addition we look to our colleagues at Boehringer Ingelheim and Corning, Inc. to attract the biomedical community to the symposium. In this manner we hope to stimulate interactions between the two communities so that practitioners from each camp can benefit from their complimentary knowledge and insights. As an example the surface scientist could learn from the biotechnologist what the current issues are facing the development of using particle technology in advanced drug delivery systems. On the other hand the surface scientist could inform the biotechnologist as to the concept and importance of the surface free energy and how it impacts the problem of attaching drug molecules to particle surfaces. It is hoped that this and other surface related issues will form the focus of the meeting and give rise to beneficial synergies between surface science and biotechnology. The Call for papers for this symposium is listed at the end of the newsletter.

We cordially invite readers of the newsletter to join us at any or all of the above meetings.

SWINE FLU VIRUS OR RECESSION VIRUS, WHICH IS WORSE

Whereas the MST newsletter is normally devoted to topics of scientific and technical interest, from time to time one has to surface and have a look at the wider world since it happens that events in other realms can have a strong impact on what would normally be considered detached engineering endeavors.

In particular, we see that the current economic implosion caused by the sub prime mortgage crisis and to a lesser extent the current fretting over the so called "swine flu" outbreak are causing waves that are spreading throughout the entire scientific, industrial and academic landscape. The subprime mortgage scandal, for instance, has caused a major downturn in the housing industry which happens to use large quantities of silicone products such as the silane materials in coatings and

sealants, which in turn puts a pinch on the profits of silane manufacturers who in turn start cutting all nonessential expenses (i.e. conferences) which finally washes over our own doorstep in terms of dramatically reduced participation in our SILANE symposium. No ship seems to be safe in the global economic ocean we all float in. In the tightly coupled global economic environment a tsunami even in some remote corner can manage to sweep through the entire system.

Dealing with the first plague first, flu viruses have been around for as long as I can remember and I have had many unpleasant encounters with the species which typically cause about two weeks of debilitating symptoms before disappearing as mysteriously as they arrived. Other than the temporary misery they inflict for most people the consequences of infection are relatively insignificant. This is not always the case, however. I distinctly remember that during my postdoctoral days I came down with a virus during the summer. Thinking it more a nuisance than something serious I kept up my usual schedule of cycling 20 miles per day even in rainstorms. That was a mistake as the virus tends to leave your immune system weakened and open to other opportunistic infections. In my case the relatively insignificant head cold degenerated into a serious case of bronchitis which shut down my cycling activity for nearly a year all because I did not want to miss two weeks of Summer riding.

Upon occasion a flu virus can be very serious indeed as evidenced by the 1918 pandemic commonly known as the Spanish Influenza¹. Curiously enough the influenza had little to do with Spain. Readers will recall that World War I was raging at the time and most countries involved in the conflict had strict bans on press coverage and something as disquieting as the influenza was quietly suppressed. Spain, however, was not among the combatants and thus published details of the outbreak in the normal manner. This gave rise to the misconception that Spain was somehow the epicenter of the outbreak as that was the only country giving press coverage. Mistakenly blaming Spain for the pandemic was just a minor consequence of this catastrophic event which, depending on whose numbers you believe, claimed between 20 and 40 million casualties worldwide. Considering that the casualties arising from the war's hostilities amounted to roughly 10 million the 1918 flu virus was a very serious killer

¹ A highly informative account of this pandemic can be found in "America's forgotten Pandemic, The Influenza of 1918"; Alfred W. Crosby (Cambridge University Press, Second Edition, 2003)

indeed. Forensic analysis after the fact determined that the 1918 pandemic was a case of what has come to be known as a PERFECT STORM, or in other words a unique event where several critical factors all conspired simultaneously to give rise to a collective result many times greater than any single factor might have caused. In the case of the 1918 pandemic the key factors were:

1. Relative ignorance of the causes and etiology of virus infections by the world community.
2. The arrival of a particularly virulent strain of the virus to which many were highly susceptible.
3. The raging global conflict which brought together millions of individuals from all corners of the globe and sequestered them in densely populated camps along with animal populations including swine which quite likely harbored the virus. These military populations eventually made their way to the various battle fronts and at the conclusion of hostilities were dispersed again worldwide. The global conflict thus provided the ideal vector for spreading the infection.

Many details of the 1918 pandemic remain a mystery even today and medical associations such as the World Health Organization (WHO) remain very cognizant of its consequences and are constantly worried about a recurrence. This has unfortunately given rise to overreaction as in the case of the SARS epidemic in 2003. By comparison to the 1918 pandemic the SARS outbreak was utterly insignificant, yet it caused the cancellation of two MST symposia which were scheduled to be held in Toronto Canada that year since the WHO had declared Toronto an epicenter of the outbreak. The reader interested in that fiasco can get full details in a previous issue of the newsletter ("Better Days Ahead: Recovering from Y2K, 9/11, Dot Com and SARS in 2005"; www.mstconf.com/Vol2No1-2005.pdf). Since then the WHO seems to have taken a more cautious approach but there has still been some negative feedback. At this juncture we have received one cancellation from the FAR EAST where the individual

involved cited the fact that due to an elevated WHO warning his institution was not allowing travel to Mexico, the USA or Canada. This incident seems to be a case of bureaucratic overreaction since the virus currently termed H1N1 seems to be everywhere but nowhere in particular. There is no developed country where the infection has not broken out and most have reported at least one fatality. Thus the bureaucrats should have restricted travel to anywhere on the planet whatever with the possible exceptions of Antarctica or the Arctic. Again the current virus outbreak is utterly insignificant compared to the true pandemic of 1918. Quite likely the reason behind this is the absence of PERFECT STORM conditions which accelerated that outbreak. Luckily the world population seems to be taking a more common sense approach this time around and putting the problem into proper perspective.

The current "recession virus", however, is causing more substantial problems than the biological outbreak. In this case we seem to be suffering from a genuine PERFECT STORM type of phenomenon where a number of factors have conspired to give rise to collective consequences which greatly outweigh the impact of any of the individual causes. Among the contributing reasons for the current economic woes are the following:

1. Careless speculation by banks and other financial institutions in derivatives markets underwritten by sub prime mortgages.
2. A dramatic runup in oil prices in the Spring-Summer of 2008 which saw a doubling of gasoline prices in the US within a matter of 4 to 8 weeks putting a major stress on homeowners already pressed to meet their mortgage payments.
3. The enormously burdensome economic overhand caused by the conflict in Iraq which by some estimates cost the US some \$80 billion per year

The above factors and possibly others conspired to cause a major implosion in the US housing and automotive industries. This in turn has had a major impact on the July SILANE symposium since these industries use large quantities of silicone and silane materials in coating and sealant applications. Several major producers of silane materials have consequently cut back severely on nonessential travel with obvious consequences for participation in conferences of any kind. We have been informed that at least two silane symposia have been canceled outright. The MST symposium is being held nonetheless but at roughly 50% of normal

participation.

**FINAL PROGRAM SEVENTH
INTERNATIONAL SYMPOSIUM ON
POLYMER SURFACE MODIFICATION:
RELEVANCE TO ADHESION to be held
July 12-15, 2009 at the University of
Maine, Orono, Maine, USA.**

This symposium continues the tradition set by the first in the series entitled: "Polymer Surface Modification: Relevance to Adhesion" which was held in Las Vegas, NV, 1993. As with its predecessors, this symposium is concerned with the technological areas where surface modification is a key technology which allows for the processing and manufacture of products which would otherwise be unobtainable.

We are indeed happy to announce that this the 7th symposium in the series will be organized in collaboration with Prof. Douglas Gardner in the Advanced Engineered Wood Composites Center at the University of Maine, Orono, Maine. Prof. Gardner is well acquainted with problems of polymer surface modification as applied to wood composites and is also serving on the editorial board of the Journal of Adhesion Science and Technology for which the Conference Director Dr. Mittal is the Editor-in-Chief. Prof. Gardner has been an active researcher in the field and he and his group look forward to hosting this symposium and greeting all participants from both academia and industry from all corners of the globe.

Proper adhesion characteristics are vital to the success of any practical implementation of polymer materials. Though polymers are generally not very adhesionable, careful surface modification can result in greatly improved adhesion without altering bulk properties. This symposium is organized to bring together scientists, technologists and engineers interested in all aspects of polymer surface modification, to review and assess the current state of knowledge, to provide a forum for exchange and cross-fertilization of ideas, and to define problem areas which need intensified efforts.

All presenting authors are invited to submit their papers for publication in the Journal of Adhesion Science and Technology (JAST).

SUNDAY JULY 12, 2009, 6:00-9:00 PM: SOCIAL HOUR/MIXER, HILL AUDITORIUM LOBBY UNIVERSITY OF MAINE CAMPUS

SESSION I: MONDAY, JULY 13, 2009

8:00-8:05: INTRODUCTORY REMARKS

8:05-8:35: F. Bessueille, S. Gout, S. Cotte, Y. Goepfert, M. Romand, A. Errachid and **D. Léonard**; Université de Lyon, Lyon, France. Laboratoire des Sciences Analytiques (CNRS, UMR # 5180), Bâtiment J. Raulin, Université Claude Bernard - Lyon 1, 69622 Villeurbanne Cedex, FRANCE; **Fabrication of Metallic Micro/Nano-Structures on Polymeric Substrates by Using Plasma or UV/VUV Treatments, Micro-Contact Printing and Selective Electroless Plating**

8:35-9:05: **K.-D. Weltmann**, R. Brandenburg, R. Foest, E. Kindel, M. Stieber, and T. V. Woedtke; Leibniz-Institute for Plasma Science and Technology e.V. (INP Greifswald), Felix-Hausdorff-Str. 2, D-17489 Greifswald, GERMANY; **Atmospheric Pressure Plasma Jets for Surface Treatment and Medical Applications**

9:05-9:35: **Yiping Qiu**; College of Textiles, Donghua University, 2999 North Renmin Road, Songjiang District, Shanghai 201620, P.R.CHINA; **Influence of Moisture on Atmospheric Pressure Plasma Treatment of Fibers and Polymers**

9:35-10:05: **Claus-Peter Klages**, Alena Hinze and Michael Thomas; Institut für Oberflächentechnik, Technische Universität Braunschweig, Bienroder Weg 53, D-38108 Braunschweig, GERMANY; **Atmospheric-Pressure Plasma Amination of Polymer Surfaces**

10:05-10:35: **Hyuk Yu**; Department of Chemistry, University of Wisconsin, Madison, Wisconsin 53706; **Plasma Treatment of Hydrocarbon Polymers & Post-treatment Dynamics of Surface Polarity**

10:35-10:50: COFFEE BREAK

10:50-11:20: **F. J. Guild** and B. R. K. Blackman; Department of Mechanical Engineering, Imperial College London, South Kensington Campus, London SW7 2AZ, UK; **Air-plasma Pre-treatment for Promotion of Thermoplastic Adhesion**

11:20-11:50: N.Gomathi, Debasish Mishra, Tapas Kumar Maity and **Sudarsan Neogi**; Department of Chemical Engineering, Indian Institute of Technology, Kharagpur 721302, INDIA; **Low Pressure Radio Frequency Plasma Treatment of Polypropylene for Improved Cell Adhesion**

11:50-12:20: **Sandra Günther**, Nico Teuscher, Andreas Heilmann, Renate Hänsel, Hans-Michael Voigt, and Andreas Kiesow; Fraunhofer-Institute for Mechanics of Materials, D-06120 Halle/S., GERMANY; **In-line Analytical Investigations of Atmospheric Pressure Plasma Processes in Correlation with Surface Analysis**

12:20-12:50: **Ranjit Joshi** and Jeorg Friedrich; Bundesanstalt für Materialforschung und Prüfung (BAM), Unter den Eichen 87, D-12205 Berlin, GERMANY; **Underwater Plasma and Glow Discharge Electrolysis (Liquid Electrode) for Polymer Surface Modification**

12:50-2:00: LUNCH

SESSION II: MONDAY, JULY 13, 2009

2:00-2:30: **Roel Dams**; VITO - Flemish Institute for Technological Research, Materials Technology Department, Boeretang 200, 2400 Mol, BELGIUM; **Inline Plasma Processes in Modified Gas Atmosphere for Adhesion Improvement**

2:30-3:00: **Muhammad Akram**; Delft University of Technology, Aerospace Materials Group, Faculty of Aerospace Engineering, Kluyverweg1, 2629HS Delft, THE NETHERLANDS; **Surface Modification of Polyimide Using Atmospheric Plasma for Increasing Adhesive Bond Strength**

3:00-3:30: **Hernando S. Salapare III**, Gene Q. Blantocas, and Henry J. Ramos; Plasma Physics Laboratory, National Institute of Physics, University of the Philippines, Diliman, Quezon City 1101, PHILIPPINES; **Cellular Adhesion Performance of Polytetrafluoroethylene (PTFE) after Surface Modification Using Hydrogen and Oxygen Low-Energy Gas Discharges**

3:30-4:00: Frédéric Busnel, Vincent Blanchard, Bernard Riedl and Pierre Blanchet; Centre de recherche sur le bois, Université Laval, Pavillon G-H Kruger, Québec (QC), G1K 7PE, CANADA; **Atmospheric Pressure Plasma Treatment on Sugar Maple (Acer Saccharum) And on Black Spruce (Picea Mariana) Wood. Study of Surface Free Energy Using Contact Angle Measurements**

4:00-4:15: COFFEE BREAK

4:15-4:45: E. V. Shun'ko and V. S. Belkin; WINTEK Electro-Optics Corporation, 1665 Highland Dr., Ann Arbor, Michigan 48108; **Cleaning and Improving Adhesion of Surfaces by Their Treatment With Excited Nitrogen**

4:45-5:15: Arthur J. Coury; Warren Avenue, Boston, Massachusetts 02116; **Exploiting Biomaterial-Tissue Interactions for Effective Medical Device Performance**

SESSION III: TUESDAY, JULY 14, 2009

8:00-8:30: M. Razdan, A. Entenberg, T. Debies, B. Parekh, P. Rai, and G. A. Takacs; Department of Chemistry, Center for Materials Science and Engineering, Rochester Institute of Technology, Rochester, NY 14623; **Surface Oxidation of Polyimides with UV Photo-oxidation in the Absence of Ozone**

8:30-9:00: Takaomi Kobayashi; Department of Chemistry, Nagaoka University of Technology, 1603-1 Kamitomioka, Nagaoka, Niigata, JAPAN; **Surface Modification of Polymer Textiles by Thermally Dried Ozone**

9:00-9:30: Susan B. Sinnott; Department of Materials Science and Engineering, University of Florida, Gainesville FL, 32611-6400; **Selective Chemical Modification of Polymer Surfaces through Low-Energy Ion-Beam Deposition**

9:30-10:00: Gloria S. Oporto, Douglas J. Gardner, and David J. Neivandt; Advanced Engineered Wood Composites (AEWC) Center, University of Maine, Orono, ME 04469; **Quantifying Short Range Adhesion Forces on Wood-Plastic Composite (WPC) Surfaces**

10:00-10:30: Sam Siau; Surface Functionalisation, ArcelorMittal R&D Industry Gent, OCAS NV, Pres. J. F. Kennedylaan 3, BE-9060 Zelzate, BELGIUM; **Adhesion Improvement of Polymers and Glues to Steel Substrates by Various Surface Modifications**

10:30-10:45: COFFEE BREAK

10:45-11:15: Wolfgang Weinhold; NNOWEP GmbH, Measuring and Testing, Haugerring 6, D-97070 Wuerzburg, GERMANY; **In Situ Microtribology with High Local Resolution on Nano-modified Surfaces on Polymers**

11:15-11:45: M. K. Mazumder, M. N. Horenstein, P. K. Srirama and R. S. Sharma; Boston University, Boston, MA; **Development of Surface Engineered Low Cohesivity Fine Powders for Respiratory Drug Delivery using Dry Powder Inhalers**

11:45-12:15: Zhi-Kang Xu; Key Laboratory of Macromolecular Synthesis and Functionalization (Ministry of Education), Department of Polymer Science & Engineering, Zhejiang University, Hangzhou 310027, CHINA; **Surface Engineering of Microporous Polypropylene Membranes**

12:15-12:45: Erhan Piskin; Hacettepe University, Beytepe, Ankara, TURKEY; **Self-Assembling of Molecules at the Surface**

12:45-2:00: LUNCH

SESSION IV: TUESDAY, JULY 14, 2009

2:00-2:30: Ulrike Schulz, Fraunhofer Institute of Applied Optics and Precision Engineering, A.-Einstein-Str. 7, D-07745 Jena, GERMANY; **Plasma Modification of Polymers for Optical Applications**

2:30-3:00: Horst-Christian Langowski; TU Muenchen, WZW Center of Life and Food Science, Chair of Food Packaging Technology, Weiherstephaner Steig 22 D-85350 Freising-Weiherstephan, GERMANY; **Surface Modification of Polymer Films for Improvement of the Adhesion of Deposited Metal Layers**

3:00-3:30: Thomas Strunskus; Ruhr University Bochum, D-44780 Bochum, GERMANY; **Ion Modifications of Metal/Polymer Interfaces**

3:30-4:00: Peter Vicca, Soeren Steudel, Jan Genoe and Paul Heremans Polymer & Molecular Electronics Group, IMEC, Kapeldreef 75. B-3001 Leuven, BELGIUM; **Polymer Adhesion Layers for Ag Layers Deposited in OLED Processing**

4:00-4:15: COFFEE BREAK

4:15-4:45: H. Willeck, W. Eberhardt and H. Kück; Hahn-Schickard-Institute of Microassembly Technology HSG-IMAT, Stuttgart, GERMANY; **A New Measuring Tool for Determining the Adhesive Strength of Micro Structured Metal Layers and Conductors Directly on Polymer Micro Devices**

4:45-5:15: D. Schaubroeck, J. De Baets, E. Schacht and A. Van Calster; Centre for Microsystems Technology (CMST)/ELIS, IMEC, Ghent University, Technologiepark 914A, BE-9052 Ghent –Zwijnaarde, BELGIUM; **Chemical Modification of a Photo Definable Epoxy Resin to Improve Adhesion with Electroless Copper**

5:15-5:45: P. Slepíčka, A.Vasina, V. Švorčák; Department of Solid State Engineering, Institute of Chemical Technology, 166 28 Prague, CZECH REPUBLIC; **Metal Nanolayers on Plasma Treated Polypropylene**

5:45-6:15: Alexander Stadnick and **Grigoriy Kyryk**; Ukrrosmetall Concern, International Institute, 6 Kursky Avenue, Sumy 40020, UKRAINE; **New Ways of Drawing Metal Films on Polymeric Materials**

SESSION V: WEDNESDAY, JULY 15, 2009

8:00-8:30: F.J. Xu, S.J. Yuan, G. L. Li, K.G. Neoh and **E.T. Kang**; Dept. of Chemical and Biomolecular Engineering, National University of Singapore, Kent Ridge, SINGAPORE 119260; **Surface Functionalization via Controlled Radical Polymerizations**

8:30-9:00: Thomas Bahnerts and Eckhard Schollmeyer; Deutsches Textilforschungszentrum Nord-West e. V., Adlerstr. 1, D-47798 Krefeld, GERMANY; **Photo-initiated Inter-Linking of Coatings on Textiles and Other Polymer Substrates**

9:00-9:30: S.A. Pihan, T. Tsukruk, A. Chifen, **R. Förch**; Max-Planck-Institut für Polymerforschung, Ackermannweg 10, D-55128 Mainz, GERMANY; **Plasma Polymerized Hexamethyl Disiloxane in Adhesion Applications**

9:30-10:00: Karina Grundke, Jan Roth, Victoria Albrecht, Mirko Nitschke, Cornelia Bellmann, Frank Simon, Stefan Zschoche, Stefan Michel, Claudia Luhmann and Brigitte Voit; Leibniz Institute of Polymer Research Dresden, P. O. Box 120 411, D-01005 Dresden, GERMANY; **Surface Functionalization of Silicone Elastomers to Form Permanently Stable Adhesion Joints**

10:00-10:15: COFFEE BREAK

10:15-10:45: Denis Dowling; University College Dublin, Room 223 Engineering Building, UCD, Belfield, Dublin 4, IRELAND; **Influence of Processing Conditions on the Adhesion Performance of Atmospheric Plasma Polymerized Primer Coatings on Steel**

10:45-11:15: N. A. Darwish, A. A. El-Wakil and **A. I. Abou-Kandil**; National Institute of Standards, Tersa Street. El-Haram. El-Giza.P.O.Box: 136 Giza. Post Code: 12211, EGYPT; **Graft Co-Polymerization of 1, 5 diaminonaphthalene to improve adhesion between EPDM Rubber and Polyester Fabric**

11:15-11:45: Gijo Raj, Eric Balnois, Christophe Baley and **Yves Grohens**; Laboratoire d'Ingénierie des MATériaux de Bretagne (LIMATB), Université de Bretagne Sud, Rue de Saint Maudé, BP 92116, F-56321 Lorient Cedex, FRANCE; **Interfaces in Biocomposites: Colloid Force Measurements Between Cellulose and Polylactic Acid**

11:45-12:15: Sang Wook Park 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; **Adhesion Characteristics of Surface-treated Glass/Epoxy Composite with Nanoparticle**

12:15-1:30: LUNCH

SESSION VI: WEDNESDAY, JULY 15, 2009

1:30-2:00: F. Griffon, C. Delval and P. Hoffmann; EPFL, Station 17, Lausanne VD 1015, SWITZERLAND; **Hot-Embossing: a Novel Technique for the Replication of Superhydrophobic Polymer Samples**

2:00-2:30: K. Schröder, B. Finke, F. Lüthen, J. B. Nebe, J. Rychly, U. Walschus, M. Schlosser, A. Ohl and K. D. Weltmann; Leibniz Institute for Plasma Science and Technology (INP), F.-Hausdorff Straße 2, D-17489 Greifswald, GERMANY; **Plasma Polymer Coatings for Improved Cell Adhesion to Titanium Surfaces**

2:30-3:00: Sean X. Liu; Cereal Products and Food Science Research Unit, National Center for Agricultural Utilization Research, U.S. Department of Agriculture, ARS, 1815 N. University Street, Peoria, IL 61604; **The Effect of Polymer Surface Modification on Polymer-Protein Interaction via Interfacial Polymerization and Hydrophilic Polymer Grafting**

3:00-3:30: Charles Anamelechi; Biomedical Engineering Department, Duke University (CIEMAS 1313), 144 Hudson Hall, Durham, NC 27708; **Endothelial Cell Adhesion to Synthetic Vascular Grafts Using Biotinylated Fibronectin in a Dual Ligand Protein System**

3:30-3:45: COFFEE BREAK

3:45-4:15: M-L. Abel, J. Bertho, P. Zdhan, V. Stolojan and J. F. Watts; The Surface Analysis Laboratory, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford Surrey GU2 7XH, UK; **Effect of Incorporation of Silanes within Epoxy Adhesives on Interface Chemistry: A Surface Analysis Study**

4:15-4:45: M. Masudul Hassan, Marco Mueller and Manfred H. Wagner Technical; University of Berlin, Institute of Material Science and Technology, Polymertechnik/Polymerphysik, Fasanen Str. 90, D-10623 Berlin, GERMANY; **Improvement of Mechanical Performance of Hybrid Seaweed/Rice Straw Polypropylene Composite: Effect of Maleic Anhydride**

4:45-5:15: N. Kasálková, Z. Makajová, K. Koljuovj, P. Slepíčka, L. Bačjkovj, M. Pačzek and V. Švorčkk; Department of Solid State Engineering, Institute of Chemical Technology, 166 28 Prague, CZECH REPUBLIC; **Cytocompatibility of Plasma-treated and Grafted Polyethylene**

FINAL PROGRAM SEVENTH INTERNATIONAL SYMPOSIUM ON SILANES AND OTHER ADHESION PROMOTERS to be held July 15-18, 2009 at the University of Maine, Orono, Maine, USA.

This symposium continues the tradition set by the first symposium in this series: "Silanes and Other Coupling Agents" which was hosted in 1991 by the Dow Corning Corporation in honor of Dr. Edwin P. Plueddemann. As with its predecessors, this symposium is concerned with the technological areas where the use of surface primers such as silanes is critical to the success of many technologies.

We are indeed happy to announce that this the 7th symposium in the series is organized in collaboration with Prof. Douglas Gardner in the Advanced Engineered Wood Composites Center at the University of Maine, Orono, Maine. Prof. Gardner is well acquainted with problems of adhesion and coupling agents as applied to wood composites and is also serving on the editorial board of the Journal of Adhesion Science and Technology for which the Conference Director Dr. Mittal is Editor-in-Chief. Prof. Gardner and his group look forward to hosting this symposium and greeting all participants from both academia and industry from all corners of the globe. Historically the silanes have been used as coupling agents for thin films in the microelectronics industry and in glass fiber composites where the use of silanes has been an enabling factor in the success of many manufactured products. Quite surprisingly, silanes have also found a role in biotechnology as specific coupling agents for bonding polynucleotides to the so-called "gene chips" and also in cosmetic applications. This symposium is organized to bring together scientists, technologists and engineers interested in all aspects of coupling agent technology, to review and assess the current state of knowledge, to provide a forum for exchange and cross-fertilization of ideas and to define problem areas which need intensified efforts. The invited speakers have been selected so as to represent widely differing disciplines and interests, and they hail from academic, governmental and industrial research laboratories. This meeting is planned to be a truly international event with participation from research groups from academia and

industry worldwide.

Finally, all presenting authors are invited to submit their manuscripts for publication in the Journal of Adhesion Science and Technology.

**SESSION I: WEDNESDAY, JULY 15, 2009
(JOINT SESSION WITH POLYMER SURFACE
MODIFICATION SYMPOSIUM)**

8:00-8:30: F.J. Xu, S.J. Yuan, G. L. Li, K.G. Neoh and **E.T. Kang**; Dept. of Chemical and Biomolecular Engineering, National University of Singapore, Kent Ridge, SINGAPORE 119260; **Surface Functionalization via Controlled Radical Polymerizations**

8:30-9:00: **Thomas Bahners** and Eckhard Schollmeyer; Deutsches Textilforschungszentrum Nord-West e. V., Adlerstr. 1, D-47798 Krefeld, GERMANY; **Photo-initiated Inter-Linking of Coatings on Textiles and Other Polymer Substrates**

9:00-9:30: S.A. Pihan, T. Tsukruk, A. Chifen, **R. Förch**; Max-Planck-Institut für Polymerforschung, Ackermannweg 10, D-55128 Mainz, GERMANY; **Plasma Polymerized Hexamethyl Disiloxane in Adhesion Applications**

9:30-10:00: **Karina Grundke**, Jan Roth, Victoria Albrecht, Mirko Nitschke, Cornelia Bellmann, Frank Simon, Stefan Zschoche, Stefan Michel, Claudia Luhmann and Brigitte Voit; Leibniz Institute of Polymer Research Dresden, P. O. Box 120 411, D-01005 Dresden, GERMANY; **Surface Functionalization of Silicone Elastomers to Form Permanently Stable Adhesion Joints**

10:00-10:15: COFFEE BREAK

10:15-10:45: **Denis Dowling**; University College Dublin, Room 223 Engineering Building, UCD, Belfield, Dublin 4, IRELAND; **Influence of Processing Conditions on the Adhesion Performance of Atmospheric Plasma Polymerized Primer Coatings on Steel**

10:45-11:15: N. A. Darwish, A. A. El-Wakil and **A. I. Abou-Kandil**; National Institute of Standards, Tersa Street. El-Haram. El-Giza.P.O.Box: 136 Giza. Post Code: 12211, EGYPT; **Graft Co-Polymerization of 1, 5 diaminonaphthalene to improve adhesion between EPDM Rubber and Polyester Fabric**

11:15-11:45: Gijo Raj, Eric Balnois, Christophe Baley and **Yves Grohens**; Laboratoire d'Ingénierie des MATériaux de Bretagne (LIMATB), Université de Bretagne Sud, Rue de Saint Maudé, BP 92116, F-56321 Lorient Cedex, FRANCE; **Interfaces in Biocomposites: Colloid Force Measurements Between Cellulose and Polylactic Acid**

11:45-12:15: Sang Wook Park 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; **Adhesion Characteristics of Surface-treated Glass/Epoxy Composite with Nanoparticle**

12:15-1:30: LUNCH

SESSION VI: WEDNESDAY, JULY 15, 2009

1:30-2:00: **F. Griffon**, C. Delval and P. Hoffmann; EPFL, Station 17, Lausanne VD 1015, SWITZERLAND; **Hot-Embossing: a Novel Technique for the Replication of Superhydrophobic Polymer Samples**

2:00-2:30: **K. Schröder**, B. Finke, F. Lüthen, J. B. Nebe, J. Rychly, U. Walschus, M. Schlosser, A. Ohl and K. D. Weltmann; Leibniz Institute for Plasma Science and Technology (INP), F.-Hausdorff Straße 2, D-17489 Greifswald, GERMANY; **Plasma Polymer Coatings for Improved Cell Adhesion to Titanium Surfaces**

2:30-3:00: **Sean X. Liu**; Cereal Products and Food Science Research Unit, National Center for Agricultural Utilization Research, U.S. Department of Agriculture, ARS, 1815 N. University Street, Peoria, IL 61604; **The Effect of Polymer Surface Modification on Polymer-Protein Interaction via Interfacial Polymerization and Hydrophilic Polymer Grafting**

3:00-3:30: **Charles Anamelechi**; Biomedical Engineering Department, Duke University (CIEMAS 1313), 144 Hudson Hall, Durham, NC 27708; **Endothelial Cell Adhesion to Synthetic Vascular Grafts Using Biotinylated Fibronectin in a Dual Ligand Protein System**

3:30-3:45: COFFEE BREAK

3:45-4:15: M-L. Abel, J. Bertho, P. Zdhan, V. Stolojan and J. F. Watts; The Surface Analysis Laboratory, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford Surrey GU2 7XH, UK; **Effect of Incorporation of Silanes within Epoxy Adhesives on Interface Chemistry: A Surface Analysis Study**

4:15-4:45: M. Masudul Hassan, Marco Mueller and Manfred H. Wagner Technical; University of Berlin, Institute of Material Science and Technology, Polymertechnik/Polymerphysik, Fasanen Str. 90, D-10623 Berlin, GERMANY; **Improvement of Mechanical Performance of Hybrid Seaweed/Rice Straw Polypropylene Composite: Effect of Maleic Anhydride**

4:45-5:15: N. Kasálková, Z. Makajová, K. Koljurovi, P. Slepíčka, L. Bačkovj, M. Pačzek and V. Svorčkk; Department of Solid State Engineering, Institute of Chemical Technology, 166 28 Prague, CZECH REPUBLIC; **Cytocompatibility of Plasma-treated and Grafted Polyethylene**

SESSION III: THURSDAY, JULY 16, 2009

8:00-8:05: INTRODUCTORY REMARKS

8:05-8:35: Barry Arkles, Youlin Pan and Eric Eisenbraun; Gelest, Inc., 11 East Steel Road, Morrisville, PA 19067; **Chemical Bonding to Metals: Hydridosilanes as Coupling Agents**

8:35-9:05: Philipp Bringmann, Franz Gammel and Irene Jansen; EADS Innovation Works, Munich, GERMANY; **Comparison of Atmospheric Plasma and Wet-chemical Derived Coupling Films as Pretreatment for Structural Bonding**

9:05-9:35: Claudius D'Silva and Catalin Fotea; School of Biology, Chemistry & Health Sciences, Manchester Metropolitan University, John Dalton Building, Chester Street, Manchester M1 5GD, UK; **Adhesion Enhancement via the Use of Silane Reagents**

9:35-10:05: Jukka Matinlinna, Pekka VALLITTU and Lippo LASSILA; University of Hong Kong, Dental Materials Science, Faculty of Dentistry, Hong Kong SAR, P.R. CHINA; **Effects of Different Silane Coupling Agents on Flexural Strength of an Experimental Filled Resin Composite**

10:05-10:20: COFFEE BREAK

10:20-10:50: Renee Goreham and Janis Matisons; Nanomaterials Group, Flinders University, SOUTH AUSTRALIA; **Kinetics and Properties of New Silane Based Anti-Corrosion Coatings**

10:50-11:20: Anthony A. Parker, Calen Bruce and David Mariasy; A. A. Parker Consulting & Product Development, Newtown, PA; **Improving Musical Instrument String Longevity with Organosilanes**

11:20-11:50: Carl Tripp; Laboratory for Surface Science & Technology, Engineering and Science Research Building, University of Maine, Orono, ME 04469; **Use of Silanes to Design Materials for Detection of Chemicals and Biological Agents**

11:50-12:20: He Huang; Department of Polymeric Materials & Engineering, Wuhan University of Technology, 122 Luoshi Road, Wuhan 430070, CHINA; **Incorporation of Nano SiO₂ Particles on PMMA Using AMP as Coupling Agent via One-stage Miniemulsion Polymerization**

12:20-1:30: LUNCH

SESSION IV: THURSDAY, JULY 16, 2009

1:30-2:00: Peng Wang; Chemical and Materials Engineering, University of Cincinnati, Cincinnati, OH 45221-0012; **Specular Neutron Reflectivity of Silane-laced Epoxy Films**

2:00-2:30: Bhanu P. S. Chauhan; Department of Chemistry, William Paterson University, Wayne, NJ 07470; **Catalytic Polysilylation: An Efficient Approach to Hybrid Materials**

2:30-3:00: Mutlu Özcan; University of Groningen, Department of Dentistry and Dental Hygiene Clinical Dental Biomaterials, Antonius Deusinglaan 1, 9713 AV Groningen, THE NETHERLANDS; **Surface Conditioning Concepts in Adhesive Dentistry: from Theory to Practice**

3:00-3:30: D. P. Dowling, C. Nwankire and M. Ardhaoui; School of Electrical, Electronic and Mechanical Engineering, UCD, Belfield, Dublin 4, IRELAND; **Influence of Precursor Chemistry on the Adhesion of Atmospheric Plasma Deposited Siloxane Coatings onto Stainless Steel**

3:30-3:45: COFFEE BREAK

3:45-4:15: M. Tiwari, **W. K. Dierkes**, R. N. Datta, A. G. Talma, J. W. M. Noordermeer and Wim J. Van Ooij; Department of Elastomer Technology and Engineering, University of Twente, 7500 AE Enschede, THE NETHERLANDS; **Tailoring Silica Surface Properties by Plasma Polymerization for Elastomer Applications**

4:15-4:45: **Garrett Matthews**; Department of Physics, University of South Florida, Tampa, FL 33620; **Functionalization of Surfaces with Glycosaminoglycans and Proteoglycans for Investigations of Cell Adhesion**

4:45-5:15: Jin Gyu Kim, Sang Wook Park, Soon Ho Yoon and **Dai Gil Lee**; KAIST, Mechanical Eng., 335 Gwahangno, Yuseong-gu, Daejeon 305-701, KOREA; **Optimum Silane Treatment of Adhesively Bonded Aluminum Joints at Cryogenic Temperatures**

5:15-5:45: **Azhar Ahmad**; Malaysian Rubber Board; **Reactive Blending of Poly(ethylene terephthalate) with Functionalized Ethylene Propylene Rubber**

SIXTH INTERNATIONAL SYMPOSIUM ON POLYIMIDES AND OTHER HIGH TEMPERATURE/HIGH PERFORMANCE POLYMERS: SYNTHESIS, CHARACTERIZATION AND APPLICATIONS; to be held November 9-11, 2009 at the Florida Institute of Technology, Melbourne, Florida, USA.

This symposium will be the sixth in a series the first of which was held in Newark, NJ in 1999. In a relatively small but significant departure from the previous symposia, this symposium will be concerned not only with the well established polyimides but also the entire range of high temperature/high performance polymers. As a loose definition this would include all polymeric materials which exhibit thermal stability above 200 C and in addition have outstanding thermal, mechanical, electrical, optical, surface and rheological properties. An example would be the Poly(p-phenylene benzobisoxazole) materials and Carbon Nanotube composites. These materials exhibit exceptional thermal, mechanical and electrical properties. Other examples would include the entire range of rigid rod polymers as well as fluorinated hydrocarbon chains that can exhibit extraordinary surface properties.

Of all these materials the polyimides have found the widest range of application in such diverse areas as the aerospace industry and microelectronic

components. The unique combination of physical and chemical properties make these materials highly attractive for demanding applications where chemical inertness, high temperature stability, low dielectric constant, mechanical toughness and processability are primary concerns. In addition, their ability to adhere to a range of inorganic materials including metals, ceramics, glasses and semiconductors have made these materials predominant in coating and composite applications. In this regard the issue of adhesion and interaction with other materials will be one of the major focal points of this symposium.

It is also our pleasure to announce that this symposium will be held in collaboration with Prof. Gordon Nelson of the Florida Institute of Technology and Dr. Martha Williams and Trent Smith of the NASA Kennedy Space Center. These individuals have been active in the area of high temperature polymers especially in regard to aerospace applications.

The invited speakers have been selected so as to represent widely differing disciplines and interests, and they hail from academic, governmental and industrial research laboratories. This meeting is planned to be a truly international event both in geographic coverage as well as in spirit. The technical program will contain both invited overviews and contributed original research papers.

TOPICS OF INTEREST INCLUDE:

- ▶ Chemistry, synthesis and characterization
- ▶ Surface chemistry and surface modification

OTHER HIGH TEMP./HIGH PERFORMANCE MATERIALS

- ▶ Examples include
 - ▶ Aramids
 - ▶ Carbon nanotubes
 - ▶ Poly phenylenes
 - ▶ High. temp. epoxies
 - ▶ Fluorinated materials
 - ▶ etc.

PHYSICO-CHEMICAL PROPERTIES

- ▶ Thermal-mechanical properties
- ▶ Electrical properties
- ▶ Adhesion properties and adhesion improvement
 - ▶ Surface treatment

- ▶ Use of coupling agents
- ▶ Controlling stress level
- ▶ Encapsulation and barrier properties
- ▶ Effects of aging and environment on long term stability, reliability and durability

APPLICATIONS

- ▶ Polyimides as adhesives and insulators.
- ▶ Polyimides as dielectrics, photoresists and encapsulants in microelectronic and biomedical structures
- ▶ Metallization of polyimide and investigation of interfaces.
- ▶ Composite applications

CHARACTERIZATION

- ▶ Chain architecture
- ▶ Bulk morphology
- ▶ Surface morphology
- ▶ Surface chemistry

NOVEL AND ADVANCED FORMULATIONS

- ▶ Ultralow dielectric materials, low thermal expansion liquid crystals, polyimide blends, nanocomposites, copolymers, foams,... etc.

This symposium is being organized by MST Conferences, under the direction of Dr. K. L. Mittal, Editor-in-Chief, Journal of Adhesion Science and Technology. Please notify the conference chairman of your intentions to present a paper as early as possible. An abstract of about 200 words should be sent by **August 15, 2009** to the conference chairman by any of the following methods:

E-mail: rhlacombe@compuserve.com

FAX: 212-656-1016

Regular mail:

Dr. Robert H. Lacombe
 Conference Chairman
 3 Hammer Drive
 Hopewell Junction, NY 12533

Contact by phone: 845-897-1654; 845-227-7026. Full conference details, abstract submission and registration via the Internet will be maintained on our web site:

<http://mstconf.com/polyimd6.htm>

INTERNATIONAL SYMPOSIUM ON SURFACE SCIENCE ASPECTS OF PHARMACEUTICAL SCIENCE, PHARMACOLOGY, COSMETICS AND BIOTECHNOLOGY, To be held April 19-21, 2010, Danbury Connecticut, USA.

The staff of MST CONFERENCES are happy to announce the inaugural symposium in a planned series on the surface science aspects of pharmaceutical science, pharmacology, cosmetics and bio-technology. The scope of the program will deal, among others, with all aspects which are critically dependent on understanding the nature of surface interactions which control the behavior and biological activity of therapeutical formulations as well as cosmetic and biomedical technologies such as bio-adhesives, drug delivery systems, cosmetic formulations and gene chip arrays.

The overall focus of the symposium will of necessity be multi-disciplinary in nature involving researchers engaged in developing new drugs to surface scientists concerned with the detailed nature of surface interactions and their accurate measurement. It is indeed a prime objective of the symposium to bring these normally disparate groups together within a forum where needs, ideas and methodologies can be discussed and mutually beneficial collaborations encouraged.

It is well recognized that a wide range of critical biological interactions occur at or across surfaces including drug absorption, cellular adhesion, autoimmune reactions, skin inflammation and cell growth to name a few. Thus in order to control or modify these processes it is first critical to understand the fundamental nature of the surface interactions which control them. It is at this level that the surface scientist and the bio-technologist can collaborate to develop innovative technologies for drug delivery, cellular and bone repair, cosmetic formulations and advanced diagnostic methods such as gene chip arrays.

On the one hand, the pharmaceutical scientists and bio-technologists can elucidate the problems and methods of their disciplines with regard to issues relating to delivery and adsorption of drug metabolites, interactions leading to inflammation or implant rejection and adverse immune system response to medical treatments. The surface scientist, on the other hand, can demonstrate how the methods of surface analysis and measurement can be brought to bear on the problem of understanding the basic surface chemistry which controls these processes. As an

example, the bio-technologist might explain the problems associated with a topical skin treatment whereas the surface scientist can demonstrate how contact angle measurements can be used to evaluate the wettability characteristics of skin and how this affects the absorption of and reaction with topical medications.

SYMPOSIUM TOPICS:

Needs of the Biomedical, Pharmaceutical and Cosmetic industries:

1. Interaction of biologically active molecules with tissue substrates.
2. Problems of drug delivery in vivo
3. Drug interactions with cellular surfaces relating to immune system response and implant rejection
4. Interactions with biomaterial surfaces
5. Biocompatibility
6. Problems relating to drug encapsulation in capsules or tablets
7. Skin surface chemistry and interactions

Tools and Methodologies of Surface Science:

1. Surface analytical methods
 - a. ESCA, AUGER, SIMS ...
 - b. Atomic Force Microscopy
 - c. Contact Angle Goniometry
 - d. Surface Micro-Calorimetry
2. Theoretical concepts of Surface Science
 - a. Hamaker theory
 - b. JKR theory
 - c. Surface thermodynamics
 - d. Acid-Base interactions
3. Surface Chemistry Modification
 - a. Silane adhesion promoters
 - b. Chemical grafting
 - c. Plasma and radiation modification

Applications:

1. Drug Delivery Systems
 - a. Delivery through fabrics made with surface modified fibers
 - b. Advanced capsule and tablet technologies
 - c. Delivery using surface activated particles
 - d. Drug screening, label free detection
2. Advanced adhesives for mending bone fractures

3. Gene chip arrays
4. Immobilization strategies of biomolecules on solid surfaces
5. Cosmetic applications

Cross-Disciplinary Studies:

1. Use of Atomic Force Microscopy to study biological surfaces
2. Contact angle measurements on skin and dental tissues
3. Bioadhesives such as hydrogels
4. Advanced adhesive applications employing the GECKO effect
5. Applications of superhydrophobicity and the LOTUS LEAF effect
6. Micro/Nano Technology; e.g. smart implants using MEMS

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

HOTEL:

Please make room reservations directly with the Danbury Plaza Hotel. A block of rooms has been set aside for conference registrants until March 15, 2010. After this date the hotel will accept reservations on a space available basis and they cannot guarantee that the special conference rate of \$99/night will apply. 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

TO SUBMIT AN ABSTRACT OR GET ON CONFERENCE MAILING LIST:

This symposium is being organized by MST Conferences under the direction of Dr. K. L. Mittal, Editor-in-Chief, Journal of Adhesion Science and Technology and in collaboration with the technical staff of the Boehringer Ingelheim and Corning corporations. It is planned to publish papers presented in this symposium in the Journal of Adhesion Science and Technology, edited by the conference director Dr. Mittal. Please notify the conference chairman of your intentions to present a paper as early as possible. An abstract of about 200 words should be sent by **December 15, 2009** to the conference chairman by any of the following methods:

BY PHONE: 845-897-1654; 845-227-7026

BY FAX: 212-656-1016

E-mail: rhl@mstconf.com

ONLINE:

www.mstconf.com/surfscipharm.htm

TWO ADHESION RELATED COURSES TO BE OFFERED AT UNIVERSITY OF MAINE JULY 11 AND 17, 2009.

SHORT COURSE ON ADHESION MEASUREMENT METHODS, JULY 11, 2009, UNIVERSITY OF MAINE, ORONO

This course presents an overview of the latest adhesion measurement techniques which are being used to evaluate the PRACTICAL ADHESION of coatings and laminate structures. 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 the structures under investigation. The effects of coating elastic properties and residual stress are considered as well as other external influences which affect durability under use conditions.

TOPICS INCLUDE:

- **Basics of adhesion measurement:**
 - Qualitative methods
 - Semi-quantitative methods
 - Fully quantitative methods
- **Role of residual stress and material mechanical properties on adhesion:**
 - Effect of coating and substrate elastic and material properties

- Effect of residual stress
- Continuum theory
- Fracture mechanics of adhesion

- **Problem of setting adhesion requirements for coating applications:**

- What is a sufficient level of adhesion strength?
- Avoid over-specifying adhesion requirements to the detriment of other product requirements.
- Problem of long-term environmental degradation.
- Method of stability maps

- **Adhesion measurement at atomic and molecular level (fundamental adhesion):**

- Surface force apparatus
- Atomic force microscope
- Hamaker theory
- Particle adhesion, JKR theory
- Contact angle behavior

- **Applications:**

- Setting quality control specifications
- Determining best measurement for given application
- Provide data base for product engineering design work
- Support new product research and development
 - Identify and eliminate potential failure modes early in development cycle
- Enable rapid effective response to unforeseen failure mechanisms

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

Level: Beginner- Intermediate introduction/overview

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

Duration: 1 day

Course materials: Includes complete set of lecture notes plus optional purchase of handbook and study guide **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 broad overview of wide range of adhesion measurement methods
- ▶ Learn optimal methods for setting adhesion strength requirements for coating applications.
- ▶ Acquire basic skills for addressing adhesion failure problems
- ▶ Know where help is available in emergency situations
- ▶ Learn how to select best measurement technique for a given application.

SHORT COURSE ON DURABILITY OF ADHESIVE JOINTS

When you make an adhesive joint as part of some device or product there is always the concern of joint durability whether the product is something as prosaic as a cereal box or as high tech as a jet aircraft. The consequences of joint failure can range anywhere from an annoying nuisance to the endangerment of lives. Thus this seminar series will give an overview of the technology and tools available for evaluating beforehand the expected performance of adhesive joints subjected to the environmental and load conditions under which they must survive.

Audience: Scientists, technicians and professional staff in R&D, manufacturing, processing, quality control/reliability involved with applying adhesives to a range of practical applications

Level: Introduction and technical overview

Suggested Prerequisites: General background In chemistry, physics or materials science.

Duration: 1 day

How you will benefit from these lectures:

Understand advantages and disadvantages of a range of test methods for adhesive joints

Gain insight into mechanics of adhesion testing and the role adhesive material properties

Explore the full range of phenomena affecting joint reliability including: adhesion to substrate, thermal-mechanical properties of adhesive and the effect of residual stress.

Review most important non-destructive inspection methods for discovering flaws in joint formation

Gain perspective from detailed discussion of actual case studies of product manufacturing and development problems

INTRODUCTION

PART ONE: OVERVIEW OF TEST METHODS

I. Two Aspects of Adhesive Action

- A. Interfacial bonding between adhesives and adherends
- B. Bulk thermal-mechanical performance of adhesives

II. DURABILITY OF ADHESIVE JOINTS: Stress and Deformation in Material Bodies, a quick overview:

- A. Stress and deformation are the primary engines driving failure of nearly all material artifacts including adhesive joints, so it is a good idea to review at least the rudiments.
- B. Continuum Theory (CT): Most fundamental and rigorous approach but unfortunately rather involved.
- C. Strength of Materials Theory (SOM): Less fundamental and rigorous than Continuum Theory but does the job in many practical instances.
- D. Fracture Mechanics: Extends both CT and SOM theory to cases where cracks and other sharp flaws are present. Most effective method for predicting catastrophic failure in structures of all kinds including adhesive joints.

III. Direct Measurement of Joint strength

1. Lap shear test
2. Double cantilever beam test
3. Four point bend test
4. Wedge test
5. ... etc

PART TWO: DETAILED LOOK AT SPECIFIC TESTS AND CASE STUDIES

IV. Tests That Measure Practical Adhesion Between Adhesive and Adherend

1. Peel test
2. Blister test
3. Indentation debonding
4. Self loading tests

V. Measuring Adhesive Thermal-Mechanical Properties

- A. The mechanical strength and temperature stability of any adhesive clearly limit its performance capabilities. Thus we need to understand the following:
1. Elastic properties
 2. Viscoelastic properties
 3. Creep behavior
 4. Concept of time-temperature superposition

VI. Role of Residual Stress

- A. If the residual stress in an adhesive gets too high then it can self destruct without further provocation from outside influences. The following are useful methods for estimating the buildup of residual stress in a material due to curing conditions, thermal cycling, solvent swelling, ... etc.
- B. Cantilevered beam methods
- a. Ultrasonics
 - b. Photoelasticity
 - c. Strain relief methods

VII. Nondestructive Inspection

- A. Any flaws left behind in the adhesive joint due to bubble formation, dewetting phenomena, undetected contamination, ... etc. will form the foci of joint failure since such defects act as stress risers and also serve as initiation points for delamination and cracking. The following can serve as effective flaw detection methods:
1. Xray
 2. Thermography
 3. Shearography
 4. Ultrasonics

I. A Closer Look at Interfacial Adhesion Through the Peel Test

II. Peel testing on a shoe string

- A. A fully functional peel test setup can be put together using equipment found in nearly any chemistry lab.
- B. Multiple strips on a single substrate are an efficient and versatile way to test interfacial adhesion.
- C. Peel testing is a handy way to perform ranking and comparative studies.

III. The Peel Test in the Development Lab and Manufacturing Line

- A. The peel test can be a very useful tool for testing adhesion improvement schemes and for analyzing and improving manufacturing processes. The following are a few examples:
1. Ranking effectiveness of adhesion promoters
 2. Evaluating the effect of manufacturing procedures on bond durability
 3. Developing improved process steps

IV. A Closer Look at The Thermal-Mechanical Properties of Polymers

- A. Nearly every adhesive formulation involves the use of a polymer resin either as a binder or as the main adhesive agent. Thus the thermal-mechanical performance of most adhesives will be dominated by the polymer component so we need to understand more about the thermal-mechanical response of these materials.

- B. Common Test methods
 - 1. Creep/stress relaxation experiments
 - 2. Dynamic mechanical experiments
 - 3. Determination of glass transition, T_g
 - 4. Relaxation processes below T_g
- C. Case Study on rubber modified epoxy structural adhesives
 - 1. Time-temperature superposition for epoxies
 - 2. Variation of fracture toughness with loading rate and temperature

- C. Case study: Adhering pins to a multi-chip module: When you require the electrical reliability of 1000 pins and absolutely positively cannot afford a single failure
 - 1. Pathology of pin failure, outline of the problem
 - 2. Modeling virtual crack propagation
 - 3. Creating a stability map

V. **Putting it All Together: A Guide to the Evaluation and Prediction of Bond Durability**

- A. Structures that survive in the long term are in a state of unconditional stability.
- B. Stability maps: An engineering tool for putting it all together.

REGISTRATION INFORMATION FOR JULY 2009 SYMPOSIA

DATES:

JULY 12-15, 2009: SEVENTH INTERNATIONAL SYMPOSIUM ON POLYMER SURFACE MODIFICATION: RELEVANCE TO ADHESION

JULY 15-18, 2009: SEVENTH INTERNATIONAL SYMPOSIUM ON SILANES AND OTHER COUPLING AGENTS

LOCATION:

University of Maine, Orono, Maine

<http://www.umaine.edu/>

HOTEL TRAVEL

These area hotels are offering special conference room rates for the nights of July 10 – 19, 2009 on a first come first serve basis.

Additional nights may be available. Continental breakfast and wireless access are included at each hotel. Rooms in July go fast. Call now to book your room.

To receive these rates, you must mention the MST Conference.

University Inn Academic Suites

5 College Ave, Orono, ME 04473

Tel: (207) 866-4921
Toll-free: (800)321-4921
Fax: (207) 866-4550

\$95.00 per night/single occupants
\$105.00 per night/2 occupants

(Be sure to mention the code MST09 to get the conference rate)

<http://universitymotorinn.com/>

Best Western Black Bear Inn

3 Godfrey Blvd. 04473

Tel: (207) 866-7120

\$109.95 per night
\$5.00 per night/each additional person

<http://www.blackbearinnoronono.com>

The following are hotels that offer free shuttles to and from the airport.

Bangor Motor Inn (207) 947-0355

Comfort Inn (207) 942-7899

Days Inn (207) 942-8272

Econo Lodge (207) 945-0111

Hampton Inn (207) 990-4400

Holiday Inn - Odlin Rd. (207) 947-0101

Ramada Inn (207) 947-6961

Super 8 Motel – Bangor (207) 945-5681

AIRPORT AND TRAVEL:

Please see the comprehensive listing on the website:

<Http://www.flybangor.com/>

Taxis are available at the exit doors on a 24 hour basis.

REGISTRATION:

Speaker/student \$395 each; regular attendee \$595 each. A 20% discount applies if you are attending both symposia. An additional 10% discount applies if more than 1 person are participating from the same organization.

ON CAMPUS HOUSING

Housing on campus is also available at a location conveniently nearby the conference meeting room. Full details on reserving accommodations are given in the form at the end of this document. Registrants are asked to fill in the form and FAX it to the number listed on the form. Questions should be directed to Debra Wright at the University of Maine. Her telephone number and E-mail address are listed at the bottom of the form. Online details are available at:

www.umaine.edu/conferences

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Dr. Robert Lacombe
Chairman
MST Conferences
3 Hammer Drive
Hopewell Junction, NY 12533-6124, USA

SHORT COURSE ON APPLIED ADHESION MEASUREMENT METHODS

JULY 11, 2009: Associated with these symposia 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.

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.

A complete syllabus of the short course is available at:

www.mstconf.com/AdhesionShortCourse.pdf

SHORT COURSE ON DURABILITY OF ADHESIVE JOINTS AND COMPOSITES

JULY 17, 2009: When you make an adhesive joint or a composite as part of some device or product there is

always the concern of the durability of the joint bond or the strength of the filler/matrix adhesion. Whether the product is something as prosaic as a cereal box or as high tech as a jet aircraft, the consequences of failure can range anywhere from an annoying nuisance to the endangerment of lives. Thus this course will give an overview of the technology and tools available for evaluating beforehand the expected performance of adhesive joints and composites subjected to the environmental and load conditions under which they must survive.

How You Will Benefit from this Course:

Understand advantages and disadvantages of a range of test methods for adhesive joints and composites

Gain insight into mechanics of adhesion testing and the role of material properties

Explore the full range of phenomena affecting composite and joint reliability including: adhesion to substrate, thermal-mechanical properties of adhesive and matrix binder materials and the effect of residual stress.

Review most important non-destructive inspection methods for discovering flaws in joint formation and composite structure

Gain perspective from detailed discussion of actual case studies of product manufacturing and development problems

A complete syllabus of the short course is available at:

www.mstconf.com/JointDurabilityV2.pdf

Audience: Both of the above short courses are tailored to meet the needs of scientists and professional staff in R&D, manufacturing, processing, quality control/reliability involved with adhesion aspects of coatings, laminate structures, composite materials or adhesive joining processes.

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).

CANCELLATIONS: Registration fees are refundable, subject to a 15% service charge, if cancellation is made by **June 20, 2009**. **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

SEVENTH INTERNATIONAL SYMPOSIUM ON POLYMER SURFACE MODIFICATION, JULY 12-15, 2009 (speaker/student)	\$395
SEVENTH INTERNATIONAL SYMPOSIUM ON POLYMER SURFACE MODIFICATION, JULY 12-15, 2009 (regular attendee)	\$595
SEVENTH INTERNATIONAL SYMPOSIUM ON SILANES AND OTHER COUPLING AGENTS, JULY 15-18, 2009 (speaker/student)	\$395
SEVENTH INTERNATIONAL SYMPOSIUM ON SILANES AND OTHER COUPLING AGENTS, JULY 15-18, 2009, (regular attendee)	\$595
Sub Total	
Deduct 20% if attending both Symposia. Deduct additional 10% if more than 1 participant from same institution	
Short Course on Applied Adhesion Measurement Methods, Select Date: <input type="checkbox"/> July 11;	\$595
Short Course on Durability of Adhesive Joints and Composites, <input type="checkbox"/> July 17	\$595
TOTAL REGISTRATION FEE	

METHOD OF PAYMENT, CHECK WHICH METHOD YOU PREFER

CREDIT CARD: Check here and fill out box below	
BANK WIRE TRANSFER: Check here and contact the symposium Chairman, Dr. Lacombe for bankwire information either by phone, FAX or E-mail: Tel. 845-897-1654 FAX: 212-656-1016 E-mail: rhlacombe@compuserve.com	
CHECK: Make check payable to MST Conferences, LLC and mail to: Dr. Robert H. Lacombe Conference Chairman 3 Hammer Drive Hopewell Junction, NY 12533-6124, USA	

CREDIT CARD INFORMATION

- VISA
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(As it appears on card)

MST Conference July 9 - 19, 2009

Housing Registration Form . Deadline for form return – Friday, June 16, 2009

Cancellation policy: Through July 1, full payment will be refunded less the \$15 processing fee.

PLEASE CHECK ONE: Male: _____ Female: _____

Name: _____ Day phone _____

Mailing address: _____

Evening phone _____ Fax # _____

E-mail address _____

Lodging on campus will be available on the nights of July 9, 2009 through July 19, 2009

Check in date: _____ Check out date: _____

Single room ~ twin bed \$60.50 per night for ____ nights _____

Double room ~ twin beds \$40.65 per person per night for ____ nights _____

Processing fee \$15.00 _____ 15.00

TOTAL REMITTED _____

Payment Information

Charge to: ____ Visa ____ MasterCard

Important: Please submit card information by fax only (207) 581-4097, not via email.

Card Number: _____

Signature: _____ Expiration Date: _____

Lodging will be at Edith Patch Hall in suites with a living area and kitchen facilities (refrigerator, stove, but no coffee maker, cooking vessels, china, or utensils). Suites have between 2 and 4 bedrooms. In suites with two bedrooms, the bedrooms are doubles. In suites with three bedrooms, there are two singles and one double. In suites with four bedrooms, there are four singles. Thus, you may list up to 4 suite mates (being sure that those you list also list you!). If you don't list suite mates, those bedrooms may be assigned to others in your program.

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| 2 | 4 |

Please use a separate form with payment for each individual

Please fax or mail completed housing form and payment to:

University of Maine

Conference Services Division – MST Conference

5713 Chadbourne Hall

Orono, ME 04469-5713

Tel (207) 581-4094, Fax: (207) 581-4097

Questions about housing at the University of Maine: Debra Wright at tel (207) 581-4094

Email: Debra.Wright@umit.maine.edu

Meeting space details of residence halls can be viewed at:

www.umaine.edu/conferences/meetingspacegallery/meetingspace.htm