The Council for Chemical Research presents:
The 11th New Industrial Chemistry and Engineering (NIChE) Conference:

Advanced Polymers
Developing High-Performance Polymeric Materials for the Future

February 5 – 8, 2006
Yacht and Beach Club at Walt Disney World, Orlando, FL

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MEETING SCHEDULE

SUNDAY, FEBRUARY 5

7:00 p.m. – 8:00 pm Registration and Opening Reception

MONDAY, FEBRUARY 6

7:30 a.m. Breakfast

8:30 a.m. **Bio-based Polymer Composites: Opportunities and Challenges**

Lawrence T. Drzal, Michigan State University

There is a growing urgency to develop and commercialize new bio-based 'green' materials and innovative technologies that can produce bio-based structural materials competitive with current synthetic products and at the same time have the benefits of reducing dependence on foreign oil, enhancing national security, improving the environment, and creating new opportunities for the agricultural economy as replacements for petroleum-based products. The present and future opportunities for biocomposite materials for transportation and building material applications can be extensive based on performance coupled with the desire for environmentally friendly materials. The challenge is more complex than simple substitution of petroleum based polymers. A comprehensive approach addressing: (i) novel processing methods combining biofibers with bioplastics; (ii) low cost but effective surface treatments of bio-fibers; (iii) use of multicomponent blends of synthetic and biofibers; (iv) and suitable matrix polymer modifications to optimize biocomposites will be required.

9:30 a.m. **Enzyme-catalyzed routes to functional macromers and polyesters**
Richard Gross, Polytechnic University

10:30 a.m. Break

10:45 a.m. **Plastics from Renewable Sources – Has the Time Come?**
Dietrich Scherzer, BASF Germany

There is not enough biomass available to cover the energy needs of mankind, but there is enough solar energy. In the long term we will have sufficient biomass, to replace fossil fuel as the feedstock for the chemical industry.

Poly (3-hydroxyalcanoates) (PHAs) have the properties to replace polypropylene (PP) in injection moulding and polyethylene (PE) in film applications.

PHAs are polyesters with a wide range of properties and are produced by microorganism using sugar as feedstock. They are the only known natural thermoplastics. Currently the properties of these polyesters are assessed and the first applications developed. But it will take time to develop eco-efficient production processes in larger scale.

The production costs of PHAs could be similar to fossil polyesters (at the same scale). In future (with rising oil prices) the cost of biobased polymers could be lower than the costs of fossil based ones.

Biobased and biodegradability are not necessary always connected. Ecoefficiency and Life Cycle Analysis need to take the performance into account. There is no good or bad plastic.

Afternoon free. Lunch on your own.

4:30 p.m. **Polyolefin Nanocomposites: Structure and Properties**
Donald R. Paul, University of Texas at Austin

This presentation will give a status report on what is known about the structure and properties of nanocomposites formed from organoclays and polyolefins. Many factors are involved in achieving a high level of dispersion, or ultimately full exfoliation, but one of the most important is the complex interaction of the polymer matrix with the organoclay. One approach is to make the polyolefin more polar (e.g., addition of maleation) while another is to optimize the structure of the organoclay. Both routes will be discussed separately and in combination; comparisons will be made with polyamides where exfoliation is much more facile.

5:30 p.m. **Nanocomposites: S&T Challenge and Defense Applications**
Jim Murday, Naval Research Laboratory

The U. S. National Nanotechnology Initiative (NNI) is one of many efforts around the globe seeking to exploit the many scientific and technological opportunities associated with the behavior of nanostructures. This talk will begin by addressing the recently revised NNI strategic plan - with special attention to the challenges poised by nanocomposites, and to the transition of nanoscience discovery into innovative technology enabled by “Nano-Inside.” Following the S&T perspective, the talk will address the potential applications for nanocomposites in defense and national security.

7:00 p.m. Dinner
Mixer and Posters

TUESDAY, FEBRUARY 7

7:30 a.m. Breakfast

8:30 a.m. **Polymer Blends for Emerging Technologies**
Lloyd M. Robeson, Air Products and Chemicals, Inc.

The utility of polymer blends in the established polymer business areas has been well-documented. As emerging technologies generate new opportunities for polymeric materials, the utility of polymer blends also will play a major role in providing unique compositions to solve specific materials related problems. These technologies include conducting polymers, biomedical/biomaterial applications, emerging battery applications, fuel cells, electronic/optoelectronic applications (e.g. LED/PV devices), and of course nanotechnology related applications. The utility of polymers in these emerging applications along a perspective of the role of polymer blends in solving the specific requirements of these technologies will be reviewed and discussed.

9:30 a.m. **Polymer-polymer Reactions to Compatibilize Blends and Enhance Adhesion**
Chris Macosko, University of Minnesota

Coupling reactions between functionalized polymers has been the major method used to compatibilize immiscible polymer blends . These interfacial reactions stabilize morphology and enhance adhesion. Polymer coupling reactions can be applied to solvent-free synthesis of copolymers producing new nanostructured materials, to hot melt coating process, and to enhancing the adhesion of coextruded films. However, it is important to predict how much copolymer will be formed to produce materials with desirable final properties. This demands characterizing and understanding the interfacial reaction under the processing conditions. This review focuses on our research which has investigated the major factors influencing the interfacial reaction including the inherent reactivity of functional polymers, thermodynamic interaction between polymers, functional group location along a chain, and flow during processing.

10:30 a.m. Break

10:45 a.m. **The Influence of Chemical Structure on Polyolefin Miscibility**
David Lohse, ExxonMobil Research & Engineering Co.

The ability to predict polymer properties from a knowledge of the chemical architecture is one of the main goals of polymer science, and achievement of this can be very useful in the development of new polymeric materials. In this talk the connection between dimensions of polyolefin chains and some of their most fundamental properties, such as miscibility, are described. The experimental and theoretical justifications of these relations are outlined in the first sections, and then the ways these can be used to predict the performance of polyolefins are demonstrated. I then show how such models can be used to design polymeric materials for optimal performance

Afternoon free. Lunch on your own.

4:30 p.m. **Blends, Alloys and Nanocomposites: Enhancing Performance through the Confluence of Chemistry and Compounding**
Paul Andersen, Coperion Corporation

As the need for new high performance compounds expands, it has become evident that in many instances neither chemistry nor compounding alone is sufficient to economically generate improved (enhanced) material properties. Polymer nanocomposites, in particular polypropylene based formulations, are a prime example. The best chemistry combined with the best compounding still does not fully exfoliate the clay. This discussion will focus on the opportunities for blending (alloying) chemistry with compounding and what issues must be addressed.

5:30 p.m. **Challenges and Opportunities of Polymer Nanocomposites and Blends for Automotive Applications**
Suresh Shah, Delphi Thermal and Interior Systems

This paper discusses the current use of Nano-Technology in Automotive Applications and their technical requirements. It gives insight of market needs and proposed steps to achieve successful and meaningful commercialization. It describes the steps the industry should take to benefit from the promise of nanotechnology. It examines the challenges and opportunities for integrating nano-composites into automotive applications such as exterior, interior, electronic and under the hood. The new innovations in nano fillers, dispersion technology and exfoliation and interfacial adhesion will help to improve cost/performance of these materials. The criteria for selection of Nano-materials for appearance, semi-structural and structural parts are discussed to develop the most cost effective strategy. Automotive industry is under significant cost pressure and although the cost of Nano-composite has reduced but still it is high and there is a significant resistance. So, the industry has to put the co-operative efforts to reduce overall system cost for a particular application.

7:00 p.m. Dinner
Mixer and Posters

WEDNESDAY, FEBRUARY 8

7:30 a.m. Breakfast

8:30 a.m. **Wood/Plastic Composites**
Rakesh Gupta, West Virginia University

Wood/plastic composites (WPCs), made by combining equal amounts of wood particulates and plastics, find applications in the building products and infrastructure market. The growth rate of WPCs is 20-25%/year, and it is the highest of any segment of the polymer industry. Here we discuss the driving forces for this growth, present what is known about polyolefin-based WPCs, outline research issues and show results on ABS-based WPCs which have the potential of delivering even better mechanical properties

9:30 a.m. **Autonomic Healing Of Polymer Composites**
Scott White, University of Illinois

Inspired by biological systems in which damage triggers an autonomic healing response, structural polymers and polymer matrix composites have been recently developed that possess the ability to *self-heal* [1]. Self-healing is accomplished via microencapsulated healing agents embedded within a polymer matrix. Damage triggers the release of the healing agent and subsequent polymerization and repair. One promising healing chemistry based on the ring-opening-metathesis-polymerization (ROMP) of dicyclopentadiene and Grubbs' catalyst has yielded static fracture recovery in excess of 90% [2] and greatly extended fatigue life [3]. In recent research, advancements in materials integration and tailored chemical activity have enabled more efficient healing, faster recovery, and more stable systems. In addition, new healing chemistries and alternate healing approaches are being explored with utility in a variety of structural polymer and polymer composite applications

10:30 a.m. Break

10:45 a.m. **Environmental Implications Of Nanotechnology**
Barbara Karn, US EPA, ORD, NCER

As a new technology, nanotechnology offers the opportunity to do it right in the first place--to design new processes and products without the old pollution. This talk will focus on using what we have learned about "green" approaches to designing new nanomaterials and products and how these approaches enable the responsible development of nanotechnology

11:45 a.m. Adjourn

PROGRAM COMMITTEE:

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