POLYMER TECHNOLOGY CENTER

Summer 2006 Edition

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MARK YOUR CALENDAR FOR PTC's NEXT CONFERENCES!

October 12 - SCRATCH
@ Detroit Michigan
November 2 - 3 - PTIC
@ Texas A & M University

ADVERTISE IN THE PTC NEWSLETTER!

If you are interested in placing an ad in the PTC quarterly newsletter, please contact Isabel Cantu. Revenue will be used for PTC student activities & research.

Related links:
http://thelook100.tamu.edu
http://www.tamu.edu/vision2020

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PTC held the Scratch meeting on April 20th and the PTIC meeting on April 21. Both meetings have broken the record for the number of companies being present. Companies in attendance were:

SCRATCH MEETING—APRIL 20

- Advanced Composites, Inc.
- Cadillac Products Packaging
- Ciba Specialty Chemical Ins
- Croda Inc.
- Dow Chemical Company
- Honda
- Hydrill
- Japan Polypropylene Corp.
- Kaneka Texas Corp.
- Kraton
- MyTex Polymers
- Phillips Sumika Polypropylene Company (PSPC)
- PolyLab LLC
- Rio Tinto Minerals
- Solvay Engineered Polymers
- Sumitomo Chemical
- Surface Machines Systems








PTIC MEETING—APRIL 21

- 3M
- Advanced Composites, Inc.
- Cadillac Products Packaging
- Ciba Specialty Chemical
- Dow Chemical Company
- Du Pont Powder Coating
- Engelhard Corporation
- EVAL Company of America
- International Paint
- Japan Polypropylene Corp.
- PolyLab LLC
- Rio Tinto Minerals
- Solvay Engineered Polymers
- SPE South Texas Section
- Specialty Minerals
- Sumitomo Chemical
- SUNOCO
- Total Petrochemicals Inc.
- Viscotek








X-ray Photoelectron Spectrometer

XPS is a powerful technique for the elemental surface detection of variations in chemical composition and oxidation state. Subtle changes in peak positions and shape can yield important information on changes in surface chemistry.

What is in the photo is a Kratos Axis Ultra X-ray Photoelectron Spectrometer in the Materials Characterization Facility (MCF) at Texas A&M University. It provides a high energy resolution capability for both conductive and insulating samples through a Kratos patented charge neutralization system.

The incorporation of the patented spherical mirror analyzer in conjunction with the standard hemispherical system in the Axis Ultra provides the ability to obtain not only high spatial resolution imaging but also a real-time parallel detection facility that allows high-quality chemical images to be obtained in only a few seconds.

A key feature of an XPS instrument is the ability to obtain spectroscopic information from a selected area of a sample without the need to translate the specimen. The ability to obtain a fast parallel chemical image that can be used as a reference to perform spectroscopic analysis is an integral part of the AXIS Ultra system. The incorporated electrostatic deflection system allows easy multi-point analysis to be carried out from within the imaged field of view.

Differential Scanning Calorimetry

Differential scanning calorimetry is a measurement technique that can provide answers to many questions. It is widely used in the plastics and adhesive industries, in safety technology, and in the chemical and pharmaceutical industries. It also provides valuable results in the electronics, automotive, aircraft, and food industries.

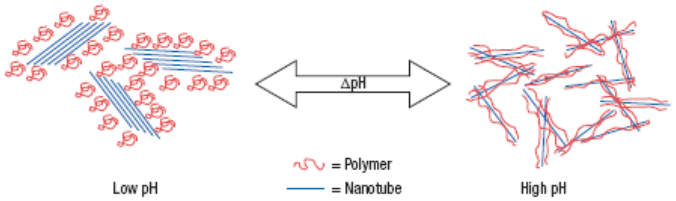
The DSC shown in figure is a METTLER TOLEDO DSC821e available in Polymer Technology Center lab at Texas A&M University. Thanks to the modular construction, this DSC is suitable for manual or automatic operation, from quality assurance and production to research and development. Up to 34 samples can be automatically processed with the TSO801RO Sample Robot. A different method or a different crucible can be used for each sample. A unique feature of the sample robot is its ability to open the crucible before the measurement. This excludes ambient influences on the sample during the wait time on the sample turntable. The capacity of this DSC is summarized as follows:

- Large measurement range (±350 mW at RT)
- High resolution (0.7 µW at RT)
- Temperature range (-150 ºC to max. 700 ºC)
- High temperature accuracy (±0.2 ºC)
- Excellent peak recognition thanks to low signal time constant (≤ 3 s)
- Suitable for small and large sample volumes
- Future-oriented owing to modular construction
- Automatable with sample robot (34 samples)

PTC would like to acknowledge and thank The Dow Chemical Company for donating the DSC machine on May 1, 2006.

DOW
Living.
Improved daily.

Grunlan discovers a new technique for controlling carbon nanotube dispersion and microstructure



COLLEGE STATION, Texas -- Dr. Jaime Grunlan, an assistant professor in Texas A&M University's Department of Mechanical Engineering, recently published an article (Grunlan et al. *Nano Letters* **2006**, *5*, 911-915) describing the ability to tailor the microstructure of carbon nanotubes in a water-based suspension and in solid composites. The key to this work is the use of a stimuli-responsive polymer whose interaction with the nanotube changes as the stimulus is changed. Initial work was done with poly(acrylic acid), using pH as the stimulus (see schematic at right), but Prof. Grunlan believes a variety of polymers and stimuli (temperature, light, glucose, etc.) could be used to accomplish the same type of control. This work is already gaining significant attention. *Nature Materials* did a "News and Views" article to highlight this work in their June issue. Only the most cutting-edge work is featured in this journal, which is published by Nature Publishing Group (http://www.nature.com/nmat/index.html).

In addition to the nanotube work, Prof. Grunlan is in the process of organizing an **industrial consortium on foil replacement** for packaging applications. A clay-filled coating has already been developed that is 100% transparent and has an oxygen transmission rate (OTR) below 0.005 cc/ m^2 day under dry conditions (below the detection limit of a Mocon unit). This coating is less than one micron thick and can be applied to any type of flexible film. Dr. Grunlan is looking for industrial partners involved in film, conversion, packaging, chemical additives, and/or nanoparticles to further develop this technology and move it toward commercialization. For information about this novel technology or joining this consortium, please contact Prof. Grunlan at (979) 845-3027 or jgrunlan@tamu.edu.

Minutes from PTIC Meeting

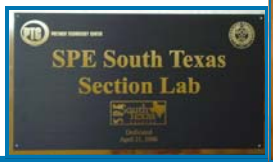
■ Polymer Nanocomposite Short Course

The PTIC consortium members indicated an interest for PTC to offer a short course on polymer nanocomposites. The advantage of conducting the short course is to allow the instructors to interact with the industrial members, such that research collaboration between PTC and the industry can be established. The PTC faculty members are excited for the opportunity to work closely with the Polymer Industry.

■ PTIC New Meeting Format

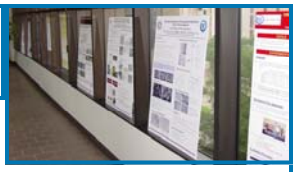
At the PTIC meeting on April 21st, the PTIC members unanimously agreed to begin the PTIC meetings on Thursday evening for a poster session, buffet dinner, polymer discussion and interaction between the Polymer Industry, TAMU Professors and Polymer Students. The meeting on Thursday will begin at 6:00pm until 8:30pm for those companies that want to take advantage of this opportunity. The Friday meeting will be from 9:00am to 2:00pm. The Poster Session and lab tours will also be available during the lunch hour on Friday for those companies that are not able to join us on Thursday.

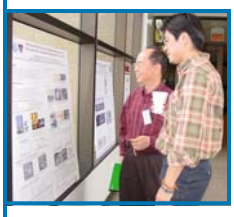
PTC Lab is Renamed



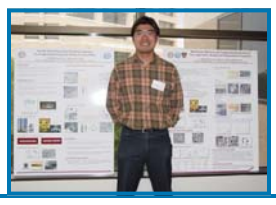
On April 21st, at the PTIC meeting, the SPE Society of Plastic Engineers South Texas Section was recognized for their continued support to the Polymer Technology Center. Andy Chatterjee (SPE representative) received the recognition certificate. With great appreciation for their continued support, it was decided that one of PTC's Laboratory be renamed to SPE South Texas Section Laboratory. This laboratory is located in the Doherty Building Room 209.

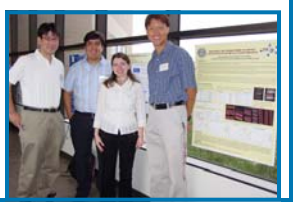
PTIC Student Poster Session





At the PTIC's student poster session on April 21st, the Polymer Industry and the TAMU Polymer students interacted on a one-on-one basis, sharing their research findings, ideas, etc. Top picture: SUNOCO's Staff Scientist Dr. Jeff Salek and TAMU Chemical Engineering student Arnab Chakrabarty discussing poster research findings. Second picture: PolyLab LLC's president Dr. Benjamin Chang and Mechanical Engineering Jia (Daniel) Liu discussing poster. Third picture: Cadillac Products Packaging Company, Dr. Colin Meyer studied student's poster. Fourth picture: Aerospace Engineering student Sumanth Banda and Professor Zoubeida Ounaies participate in the poster session. Other students from Mechanical Engineering Dept. Kamran A. Khan, Jia "Daniel" Liu, WJ Boo and from Chemical Engineering, Selma Atilhan, Oscar Ojeda and PTC Visiting Scholar from Japan Hidehito Ikeda all have participated in the poster session. Thanks to all the students that participated in the poster session; PTC had a great turn out of posters.





POLYMER TECHNOLOGY CENTER

Update on the Undergraduate Polymer Specialty Certificate Program

The Undergraduate Advisors Committee met on April 10th, and unanimously approved the Undergraduate Polymer Specialty Certificate Program. This item than appeared on the agenda of the Undergraduate Curriculum Committee meeting, which met on June 9th, the Committee also approved this item. The Polymer Certificate Program will now go to the Faculty Senate for their July 10th meeting. Contingent upon the approval from the Faculty Senate, this item will than go to Dr. Robert M. Gates, President of Texas A&M University for his approval. PTC is eagerly anticipating to get this Program underway.

Benefits

The value of the certificate to the student will be to broaden his or her exposure to a diverse polymer science and engineering curriculum, thereby differentiating the student from their peers.

Industry will value graduates with the Polymer Specialty Certificate because they will have a more diverse background in polymers. Further, the graduates will have a focus that will foster entrepreneurial thinking and expand the employment horizons beyond the traditional industrial jobs.

Description

The proposed undergraduate Polymer Specialty Certificate Program will consist of four 3-three hour courses for a total of 12 credit hours. Two of the courses will be core curriculum, which will count for 6 credits toward the student's departmental degree. Core courses will include MEEN 458 (Processing & Characterization of Polymers) and CHEM 466 Polymer Chemistry. An additional six hours will be comprised of two 3-hour science or engineering electives. Completion of 12 semester credit hours of the following courses earn a Polymer Certificate and the specialty is recorded on the student's permanent University record.

1. Core Curriculum - 6 semester credit hours

Course Code	Course Title	Instructor	When Offered	Frequency Offered	Credit Hours
MEEN 458	Processing & Characterization of Polymers	Jaime Grunlan	Spring 2006	Annually/Spring	3
CHEM 466	Polymer Chemistry	Stephen A. Miller	Spring 2006	Annually/Spring	3
CHEN 451	Intro to Polymer Engineering	Michael Bevan	Fall 2006	Annually/Fall	3
MEEN 455	Engineering with Plastics	Hung-Jue Sue	Fall 2006	Annually/Fall	3
MEEN 471	Elements of Composite Materials	Terry S. Creasy	Spring 2006	TBA	3
AERO 489	Polymer and Composites	Zoubeida Ounaies	Spring 2007	TBA	3
MEEN 451	Viscoelastic Solids	Anastasia Muliana	Fall 2006	TBA	3
MEEN/CHEN/ AERO/ CHEM 485	Individual Research	PTC Faculty	Spring 2006	Every Semester	3
BMEN 482 & 682	Polymeric Biomaterials	Melissa A. Grunlan	Spring 2006	TBA	3
CHEN 642	Colloidal & Interfacial Systems	Michael Bevan	Spring 2006	Even years/ Spring	3

A grade of C or above is required in all of the above courses.

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ANTEC 2006 Annual Technical Conference Charlotte, North Carolina May 7-11

TAMU Presentations at the ANTEC Conference

Preparation, Intercalation and Exfoliation of α-Zirconium Phosphate with Varying Dimensions in Epoxy

Luyi Sun[1,2], Woong J. Boo[2], Hung-Jue Sue[2,], Abraham Clearfield[1,*]*

Presentation date & time: May 8, 2006 @ 10:00am

Abstract

Synthetic α-zirconium phosphate (α-ZrP) platelets with varying dimensions have been prepared, intercalated, and exfoliated in epoxy. Such intercalated/exfoliated α-ZrP sheets with varying aspect ratios can be used as nanofillers to study the structure-property relationship in polymer nanocomposites.

Effect of Aspect Ratio on Mechanical Behavior of Nanoplatelet-Reinforced Epoxy Nanocomposites

W.-J. Boo, L. Sun†, E. Moghbelli, J. Liu, A. Clearfield†, and H.-J. Sue

Presentation date & time: May 08, 2006 @ 3:30 pm

Abstract

The morphology, fracture behavior and physical/ mechanical properties of synthetic a-zirconium phosphate based epoxy nanocomposites with variations in aspect ratio of nanoplatelets are investigated. The aspect ratio of nanoplatelets as well as the state of exfoliation and dispersion is directly confirmed by transmission electron microscopy (TEM). The fundamental structure-property relationship of a-ZrP reinforced epoxy nanocomposites as a function of aspect ratio of a-ZrP layer structure is discussed.

Parametric Study of Polymer Scratch Behavior

Han Jiang, G.T. Lim, J.N. Reddy, J. Whitcomb & H.-J. Sue

Presentation date & time: May 9, 2006 @ 3:00

Abstract

The effect of material and surface properties of polypropylene (PP) on scratch behavior were discussed by parametric studies using finite element analysis (FEA). Two different loading conditions were examined. It is found that Poisson's ratio has a negligible effect on scratch performance. Increasing yield stress and reducing coefficient of adhesive friction are important ways to positively affect the scratch performance of polymer. However, increasing the Young's modulus does not necessarily improve scratch performance.

Scratch Behavior of Polymer Coatings

R. L. Browning, G.-T. Lim, H. Jiang, A. Moyse and H.-J. Sue

Presentation date & time: May 9, 2006 @ 4:30pm

Abstract

A recent standardized scratch test methodology was applied to investigate the performance of a set of experimental acrylic coatings. Coating ductility and coating thickness were varied to study how they affect coating cohesive strength, adhesive strength and chipping resistance. The usefulness of the new ASTM scratch test for polymer coatings is discussed.

Scratch Behavior of Model Polypropylene Thin Sheets

Ehsan Moghbelli, Robert Browning, Steve Hahn, HungJue Sue

Presentation date & time: May 10, 2006 @ 9:00am

Abstract

The effects of molecular weight (MW) and surface morphology on scratch behavior of model polypropylenes (PP) were investigated. The results suggest that scratch performance is improved when the MW PP is high and the cooling rate is low. Correlation between surface properties and scratch resistance of PP was established and discussed.

PTC Newsletter prepared by: Isabel Cantu
Edited by: William Neil Everett & Jonathan O'Reilly