Polyethylene Terephthalate Technology (PET)

May 18 – 20, 2009
8 a.m. – 5 p.m.
at the Hilton Toledo, Toledo, OH

Stay up-to-date with this specialized seminar on the interrelationships among PET properties, fabrication processes, and end-use properties, including a discussion of PEN.

Presented by The University of Toledo
Division of Continuing Education

4 EASY WAYS TO REGISTER:
1) MAIL the completed registration form with VISA/MASTER CARD information or with a CHECK or MONEY ORDER to: The University of Toledo, Division of Continuing Education, Mail Stop 450, Toledo, OH 43606-3390.
2) FAX the completed form with payment information to 419.530.8779.
3) E-Mail complete registration and payment information to joanne.goins2@utoledo.edu.
4) Phone 419.530.6182 or 419.530.3052, 9 a.m. to 5 p.m. EST.

Registration is limited and your registration must be confirmed prior to the seminar. Confirmation of participation will be sent upon receipt of your registration and payment.

FEE: The registration fee of $1,550 includes a 456 page course notebook, coffee breaks and lunches (on the first two days).

REGISTRATION DISCOUNT: Send two people and receive a 10% discount. Send three or more persons and receive a 20% discount.

PROGRAM SCHEDULE: Check-in for the seminar begins at 7:30 on May 18th. The seminar schedule is 8:00 a.m. – 5:00 p.m. on May 18 and 19 and 8:00 a.m. – noon on May 20.

LOCATION: The seminar will be held at the Hilton Toledo, 3100 Glen ore Avenue, Toledo, OH 43614. Guest rooms are $92+tax per night while available. This block of rooms will be held until May 1, 2009. When making a reservation at PH: 419.381.6800, identify yourself as a member of the PET Group. Participants are responsible for making their hotel/travel arrangements.

CANCELLATION POLICY: Cancellations received by 7 business days prior to the start of the program are entitled to a full refund. Cancellations received fewer than 7 business days are entitled to a 50% refund of the course fee to cover expenses for which we have guaranteed payment. You may send a substitute but please advise us in advance. No fees will be refunded after the program begins.

The University of Toledo reserves the right to change schedules or facilities or cancel any classes due to limited enrollment or circumstances beyond our control. Registered participants will be notified of any changes prior to the first day of class.

CONTINUING EDUCATION UNITS: Participants receive 0.1 CEU for each hour of class.

FOR FURTHER INFORMATION: Please call Jody at 419.530.6182 or Betty at 419.530.3052.

REGISTRATION FORM

PET Technology May 18 – 20, 2009

Mr. Mrs. Ms. _____________________________________________________________

Title ____________________________________________________________________

Mail Label Code ___________________ (located directly above your name of the mailing label)

Department _________________________ Organization _______________________

Address _____________________________ City _______________________________

State _______________________________ ZIP Code ___________________________

Phone ______________________________ FAX _______________________________

Home Phone ____________________________________________________________

E-Mail __________________________________________________________________

Fee: $1550

Check/Money Order Enclosed (Make check payable to The University of Toledo)

Company Purchase Order Enclosed P.O. Number _____________________________

○ MasterCard ○ VISA

Exact Name on Credit Card ________________________________________________

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Please return the completed form with payment information to:
The University of Toledo
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Mail Stop 450
Toledo, OH 43606-3390
**Seminar Benefits**

This course will bring together in a cohesive manner the interrelationships among material properties, fabrication process, and end-use properties. Polyoxyethylene Terephthalate (PET) has become the material of choice for many new applications in the food and beverage, medical and pharmaceutical, household and chemical, and electronic and automotive markets. The end-use applications of PET are found in rigid and flexible packaging, composite molded structures, tapes and discs of various kinds. The fabrication processes include injection molding, blow molding, extrusion, thermoforming, and film orientation. The ease of fabrication, the quality of the fabricated products, and the end-use properties are all dependent on basic material properties and specific responses during the various steps of each of the processing methods used to convert PET pellets into the desired final product.

The technical information presented is based in part on systematic studies which have been carried out by the course instructor for the last 30 years, along with information extracted from textbooks and professional journals. Staying up-to-date with current PET Technology can offer significant cost benefits for your organization. It is essential to decision-making for PET purchasing, processes, problems and solutions, and how these decisions can affect your bottom line.

This seminar will benefit:
- Processing Engineers
- Production Managers
- Quality Control Managers
- Chemists and Chemical Engineers
- Designers and Packaging Engineers
- Recyclers engaged in resin manufacturing, production of films, parisons, and bottles, and end-users of products for beverage, food, and pharmaceuticals

**Seminar Leader: Dr. Saleh A. Jabarin**

Dr. Saleh A. Jabarin is the director of the Polytechnic Institute and professor of chemical engineering at the University of Toledo. He holds a bachelor’s degree in chemistry from Dartmouth College, a master’s degree in polymer science from Brooklyn Polytechnic Institute, and a PhD in polymer science and engineering from the University of Massachusetts. He has over sixteen years of industrial plastic research and development experience, along with information extracted from textbooks and professional journals.

**Seminar Outline**

1. **Introduction**
   a. PET uses
   b. General characteristics
2. **PET Preparation and Chemistry**
   a. Raw materials
   b. Synthesis of PET
   c. DT: melt phase
   d. Solid state
   e. Catalysts
   f. PET homopolymerization kinetics
3. **Interactive Matrix of Resin Properties, Processing, and End-Use Properties**
4. **Basic Resin Characteristics**
   a. Molecular weight and intrinsic viscosity (IV)
   b. Melting behavior: melting point and heat of melting
   c. Percent crystallinity
   d. Carbon end groups
   e. Catalysts
   f. Residual acetaldehyde
   g. Color index
5. **Processes for Making PET Containers, Films and Fibers**
   a. Injection molding
   b. Stretch blow molding
   c. Extrusion
   d. Extrusion/Thermoforming
   e. Film orientation
   f. Fiber spinning
6. **Drying of PET Resins**
   a. Reasons for drying
   b. Drying procedures
   c. Requirements of drying
   d. Dryer design and residence time and temperature distribution
7. **Injection Molding**
   a. Cooling/clarity and crystallization
   b. Acetaldehyde generation
   c. IV and molecular weight distribution
   d. Parisons (preforms) properties and troubleshooting
   e. Injection molding guidelines
8. **Crystallization**
   a. Methods of studying crystallization
   b. Relationships between haze and crystallinity
   c. Factors affecting crystallization
   d. Factors affecting crystallization
   e. Morphology and structure of thermally crystallized PET
9. **Orientation**
   a. What is orientation
   b. How to achieve it
   c. How to measure it
   d. What does it do
   e. Factors affecting orientation
   f. Orientation vs. strain-induced crystallization
   g. Morphology and structure of oriented PET
10. **Stretch Blow Molding**
    a. Single vs. two stage process
    b. Orientation and crystallization during blow molding
    c. Preform design
    d. Factors affecting orientation/stretch blow process
    e. Heat set process and containers
    f. I.R. Heating
    g. Stretch blow molding guidelines
11. **Fiber Spinning and Fiber Properties**
    a. General description of spinning operations
    b. Melt spinning
    c. Dry and wet spinning
    d. Fiber after-treatments
12. **Heat Set Technology**
    a. Basic principles of heat setting
    b. Heat settings
    c. Barrier properties of PET
    d. Thermal crystallization
    e. Heat setting
    f. Applications
    g. Heat set mold temperatures of 130°C or less
    h. Heat set mold temperatures of 150-200°C
13. **Shrinkage**
    a. How to reduce shrinkage
    b. Resin IV
    c. Moisture control
    d. Melt temperature
    e. Molding conditions
    f. Resin IV
    g. Moisture
    h. Speed
    i. Residual stresses
14. **Factors Affecting Shelf Life of PET Containers**
    a. Permeation and barrier properties
    b. Creep
    c. Stress
    d. Material distribution
    e. I.V.
15. **New Packaging Applications of PET**
    a. New process development
    b. Coinjection molding/multilayer
    c. Heat settings
    d. Barrier developments
    e. High barrier materials
    f. Scavengers
    g. Coatings: external and internal
    h. Blends of polyesters, nylons and nanocomposites
    i. PET/product matrix
    j. PET vs. PLA