POLYMER REACTION ENGINEERING

Monday, March 30
to
Thursday, April 2
1998

PROGRAMME

Monday, March 30

Morning Session 9:00-12:30 — CHAIN-GROWTH POLYMERIZATION MECHANISMS AND KINETICS

An introduction to free radical and ionic (heterogeneous and homogeneous Ziegler-Natta and metallocene catalysis) polymerization kinetics.

Topics include:

- Linear, branched and crosslinked chains via free-radical mechanisms
- Linear and branched chains via ionic mechanisms (heterogeneous and homogeneous Ziegler-Natta and metallocene catalysis)
- Stockmayer's bivariate distribution-instantaneous property methods.

Afternoon Session 2:00-5:30 — ADVANCED POLYMERIZATION KINETICS

Topics include:

- Identification of multiple active site types (GPC, TREF/NMR, TREF/GPC/NMR)
- Identification of active site performance
- Long chain branching
- Ziegler-Natta and metallocene catalysis

Tuesday, March 31

Morning Session 9:00-12:30 — EMULSION/DISPERSION/ SUSPENSION PROCESSES

Topics include:

- Styrenics, PVC
- Batch, semi-batch and continuous operation
- Relevant thermodynamics and surface chemistry
- Particle nucleation/growth
- Ionic/steric stabilization
- Particle size distribution and molecular weight distribution

Afternoon Session 2:00-5:30 — STEP-GROWTH POLYMERIZATION

Topics include:

- Introduction to polycondensation mechanisms and kinetics
- Linear, branched and crosslinked chains via step-growth mechanisms
- Overview of typical industrial reactors and processes
- Modeling of industrial reactors: polyamides (nylon-6, nylon-6,6), polyesters (PET)
- Solid-state polymerization

Wednesday, April 1

Morning Session 9:00-12:30 — POLYOLEFINIC PROCESSES

Topics include:

- Molecular, rheological and solid state properties which are relevant to production, processing and end use applications of polyolefins (LDPE, HDPE, LLDPE, polypropylene, and copolymers)
- Effects of short and long chain branching and molecular weight distributions
- Effects of main process variables on productivity and polymer properties
- Models of polyolefin production processes and plant data comparisons. Examples will include free radical high pressure processes (tubular and autoclave reactors) & heterogeneous catalytic processes (slurry and gas phase)

Afternoon Session 2:00-5:30 — PRINCIPLES OF POLYMER REACTOR MODELLING AND KINETIC DATA COLLECTION

In this section, ideas from all previous lectures (i.e. physico-chemical phenomena operative in polymerization systems) will be incorporated into a mathematical model. Steps for the development of a polymerization model will be outlined, and applications/uses of models will be discussed. Important modern aspects on parameter estimation and the optimal design of experiments in aid of meaningful kinetic data collection will also be highlighted.

Topics include:

- Batch, semi-batch and continuous operation
- Dynamic modelling of reactor systems
- Population balance equations for particle size and molecular weight
- Screening and factorial designs for data collection
- Sequential and non-linear design of experiments
- Evolutionary operation
- Model discrimination issues

Thursday, April 2

Morning Session 9:00-12:30 — MODERN SPECIAL TOPICS

Topics include:

- Bulk/solution/emulsion terpolymerization
- Reactivity ratio estimation
- Monte Carlo methodology/applications
- Reactive processing
- Measurement of long chain branching (GPC/VISC/LALLS)
- CRYSTAF: Crystalization Analysis Fractionation ia a new technique for the analysis of composition distribution in semicrystalline polymers, and more specifically for the analysis of branching distribution in polyethylene and tacticity in polypropylene type resins

Afternoon Session 2:00-5:30 — MONITORING, DYNAMICS AND CONTROL OF POLYMERIZATION PROCESSES

A good understanding of the reaction mechanisms and of the dynamic behaviour of the reactor system is essential to ensure safe and stable operation and achieve tight product quality control.

Topics include:

- Overview of current control practices
- Sensors for monitoring reactor behaviour
- Energy balance and rate control
- Control of product properties
- Model uses to combine on-line and off-line data
- Kalman filtering and inferential control
- Software sensors and multivariable statistics
- Optimal reactor grade changes
- Advanced linear and non-linear control

5:30 — ADJOURNMENT

GENERAL INFORMATION

COURSE FEES

The cost per person is $1000 US. Two people from the same organization will be charged $1800. Academic participants will be charged $ 600.00 US. **(please ensure cheques are in US dollars drawn on a US bank).**

For advance registrations before February 13, 1998, there is a special discount of 5%.

The course is being held at:

The Imperial Hall
Rua da Consolação 3555
Jardins
CEP 01416-001
São Paulo, SP, Brasil
Tel: 55+11+853-6933
Fax: 55+11+852-1005

YOU MUST MAKE YOUR OWN HOTEL RESERVATIONS

When contacting The Imperial Hall, please indicate that you are attending the Polymer Reaction Engineering course to obtain the special rate.

CANCELLATION

An administration fee of 15% will be charged for cancellations received before March 16, 1998. **NO REFUNDS after that date.**

COURSE NOTES

The course notes have recently been updated and expanded and are included in the cost of registration. Copies are available for purchase by non-participants for $400 US. Notes will be given to participants at 8:50 am just before lectures start.

LECTURERS

The lectures will be given by the course directors:

Dr. A.E. Hamielec, Professor Emeritus and Director of McMaster Institute for Polymer Production Technology, Department of Chemical Engineering, McMaster University, Hamilton, Ontario, Canada.

Dr. A. Penlidis, Professor and Director of the Institute of Polymer Research, Department of Chemical Engineering, University of Waterloo, Waterloo, Ontario, Canada.

Dr. J. B. P. Soares, Assistant Professor, Department of Chemical Engineering, University of Waterloo, Waterloo, Ontario, Canada

Invited Lecturer:

Dr. R. Giudici, Professor, Universidade de São Paulo, Escola Politécnica, Departmento de Engenharia Quimica, São Paulo, SP, Brasil.

IN-HOUSE COURSES

Drs. Hamielec, Penlidis and Soares are available to conduct in-house courses specifically tailored to your needs and requirements. Secrecy agreements could be signed permitting the consideration of highly relevant material.

Further information on this course or other courses may be obtained from Professor A. Penlidis at:

Department of Chemical Engineering
University of Waterloo
Waterloo, Ontario, Canada, N2L 3G1
Tel: (519) 888-4567 ext. 6634
Fax: (519) 746-4979
E-mail: penlidis@cape.uwaterloo.ca