Emulsion Polymers Consulting and Education, LLC presents

Hybrid Latex Systems-
PU, Alkyd and Inorganic/Acrylic Latexes

3 Day Interactive Workshop
May 18-20, 2020
VTEC Training
Portland, Maine, USA

Faculty
Donald C. Sundberg, PhD
John G. Tsavalas, PhD
W. Marshall Ming, PhD

WORKSHOP OBJECTIVES: This workshop is designed to provide industrial scientists and engineers with an intensive, interactive workshop on the synthesis and use of several types of hybrid latexes. Among these are *alkyd/acrylic*, *polyurethane acrylic* and *inorganic/organic* polymer latexes. The similarities to, and differences from, standard latex polymerizations are presented in great detail so that the participant has the opportunity to grasp the fundamental aspects of the polymerization reactions and colloid chemistry associated with making such morphologically interesting particles. The alkyd, polyurethane and inorganic dispersions required as a first step in the production of hybrid latices usually require special techniques and these will be reviewed as part of the workshop.

INTENDED AUDIENCE: We have designed this workshop for industrial scientists and engineers who have some background in "standard" emulsion polymerization techniques, and who are interested/engaged in extending their experience to include the synthesis, characterization and use of hybrid latices.

STRUCTURE OF THE WORKSHOP: This 3-day workshop will be conducted in a ***highly interactive manner*** with participants engaged in discussions, demonstrations, and problem solving.

REGISTRATION INFORMATION

The registration fee includes the full book of slides for the workshop, coffee breaks, and Tuesday evening dinner. It does not include accommodations or travel. Early registration is recommended due to the workshop size limitation of 24 participants.

Registration Fee: $1700 USD
Registration Form --> Go to page 5

Contact for further information:
info@epced.com

Daily Schedule:

Day 1

AM:

- Basics of emulsion polymerization
- Particle size control
  Copolymer composition control
- Colloidal stability
- Structured latex particles
- Characterization of latices and other dispersions
- Introduction to latex film formation

PM: **Organic/inorganic hybrid particles**

- Why incorporate inorganics into latex particles?
- Morphological control (thermodynamic vs. kinetic)
- Introduction to Pickering Emulsions
- Making organic/inorganic hybrid particles
  - Emulsion polymerization
  - Mini-emulsion polymerization
  - Dispersion polymerization
  - Heterocoagulation

- Various organic/inorganic hybrid particles
  - Polymer/silica hybrid particles
    - ✓ Core-shell particles
    - ✓ Pickering stabilization
- Polymer/clay hybrid particle
    - ✓ Clay encapsulation
    - ✓ Clay-armored latex particles
- Polymer/CNT hybrid particles
- Magnetic hybrid particles

Day 2

AM: **Organic/inorganic hybrid particles, continued**

- Other organic/inorganic hybrid particles
    - ✓ Stimuli-responsive organic/inorganic hybrid particles
    - ✓ Polymer/metal hybrid particles
- Film formation of organic/inorganic hybrid particles
- Properties of coatings from organic/inorganic hybrid particles

Day 2

Alkyd/Acrylic Latex Particles

- What is an alkyd/acrylic hybrid? How is it different than other polymer/polymer hybrids?
- Incentives for an alkyd/acrylic hybrid latex
  - synergy of properties from solvent borne and waterborne coating systems
  - no VOC
- Brief background of solvent borne alkyd coatings
- Alkyds: chemistry, structures, fatty acid constituents, double bond content & degree of unsaturation

- ***Alkyd/Acrylic Latex***
  - Hydrophobicity of alkyd precludes its use in traditional emulsion polymerization
  - Miniemulsion polymerization
    - applicability to this system and typical procedures

PM: **Alkyd/Acrylic Hybrid Latex**

- Hybrid particle morphology
  - Target morphologies
  - Thermodynamic vs. kinetic control
  - Characterization
  - Challenges/constraints
- Grafting of alkyd & acrylic phases
  - Mechanisms
  - Characterization
  - Implications
- Kinetics of Acrylic Polymerization in Presence of Alkyd
    - Retardation
      - ✓ Function of type of alkyd used
    - Limiting monomer conversion
      - ✓ What is this? What levels of unreacted monomer?
      - ✓ Theories as to why this occurs in this type of system
      - ✓ Methods to overcome and finish the residual monomer

Day 3

AM: **Alkyd/Acrylic Hybrid Latex, continued**

- Film formation of alkyd/acrylic latex
    - Auto-oxidative cross linking of alkyd residual double bonds with drying oils
    - No drying oil added
- Properties of alkyd/acrylic latex films

Polyurethane/Acrylic Hybrid Latex Particles

➢ ***Aqueous polyurethane dispersions***

- VOC driving force
- Types of PU's that are useful as PUD's
- Creating PUD's
    - Chemistry, stabilization

    Dispersion process, particle size control
    - Use of NMP and other solvents
    - Hydrogen bonding, hard segment nano-domains
    - Water content in PU particles
- Film applications
- Coating properties

Day 3

➢ ***PU/Ac hybrid latex particles***

- Driving force for PU/Ac latex
- Types of acrylics of interest
- Morphological alternatives
    - Thermodynamic control
    - Kinetic control

PM: **Polyurethane/Acrylic Hybrid Latex Particles, continued**

- Polymerization processes
    - PUD as "seed" particles, pH control
    - Batch and semi-batch acrylic polymerization
    - Grafting to PU backbone
    - Reaction kinetics, including starve fed
        - ✓ Initiator systems
        - ✓ Reaction temperature ranges
        - ✓ Simultaneous condensation polymerization of urethane and free radical polymerization of acrylic
    - Establishing phase structure in PU/Ac composite particles
    - Effect of annealing
    - Hydrogen bonding issues
- Properties of composite films
    - PUD – Ac latex blends
    - PU/Ac composites

Faculty Profiles

Professor Donald C. Sundberg has been working in the field of emulsion polymers for 52 years. He received a bachelor's degree in chemical engineering from Worcester Polytechnic Institute (Massachusetts) and his Ph.D. from the University of Delaware. He worked on latex based impact modifiers for ABS resins with the Monsanto Company, scaling processes to the 10,000 gallon reactor size. He has extensive research experience in emulsion polymerization and is widely recognized for his work on structured latex particles. This has resulted in 100 peer reviewed publications and many conference papers. In addition he has conducted many workshops, most notably the one on latex particle morphology control. He spent a sabbatical year at the Institute for Surface Chemistry in Stockholm and was Chair of the 1997 Gordon Research Conference on Polymer Colloids. He is the 2016 Mattiello Memorial Lecture awardee from the American Coatings Association. His research interests are in polymerization kinetics in solution, bulk and emulsion systems, interfacial science and polymer morphology control, diffusion in polymers, and coatings. He is an Emeritus Professor of Materials Science at the University of New Hampshire and is the founder of Emulsion Polymers Consulting and Education, LLC.

Professor John G. Tsavalas is an Associate Professor of Chemistry at the University of New Hampshire, the director of the Nanostructured Polymers Research Center, and the deputy director of an interdisciplinary multi-department research center at UNH centered around Advanced Materials (CAMMI). He received his PhD in Chemical Engineering from The Georgia Institute of Technology (Atlanta, GA, USA) after which he was a Senior Research Scientist in The Dow Chemical Company (Midland, MI USA). In industry he worked on a wide variety of polymer colloid related R&D with particular emphasis on nanostructured latex particles. At the University of New Hampshire, Professor Tsavalas' current active areas of research are colloidal nanostructure morphology development, sustainably derived polymer colloids, the interaction and distribution of water in polymer colloids, and dynamic modeling of interactions, kinetics, diffusion, and phase separation in colloidal systems.

Prof. W. Marshall Ming is currently the Distinguished Chair in Materials Science and a Full Professor in Chemistry at Georgia Southern University. Prior to joining Georgia Southern in 2011, he was a faculty member at University of New Hampshire (2007-2011) and Eindhoven University of Technology (2000-2007) in The Netherlands. His current research focuses on multifunctional polymer materials and coatings, including super-repellent, antimicrobial, antibioadhesion, antifogging/frost-resisting, and self-healing coatings, as well as smart coatings for detection of early metal corrosion and preemptive corrosion prevention. He has so far published 83 peer-reviewed papers, 8 book chapters, and 3 issued US patents. He received a First-Place Roon Award from American Coatings Association in 2012.

Registration Form

Hybrid Latex Systems
Portland, Maine, USA
May 18-20, 2020

Name____
Address____
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City/State____
Postal Code____
Country____
Position or Title_______________________________________
Organization____
Phone____
Fax____
E-mail____

Participant Category

- ☐ Standard price for industrial participant: $1700 (USD)
- ☐ Discounted price for additional participant(s) from the same company: $1600 (USD)
- ☐ Academic participant: $1300 (USD)

There is a non-refundable fee of $50 (USD). Cancellation of registration can be made up until April 18, 2020 with a full refund minus the $50 processing fee.

Method of Payment:

☐ Credit Card
___Visa ___MasterCard ___American Express
Card #____
Visa or MC Security Code # (last 3 digits on back of card)_______________
AMEX Security Code # (4 digits on front of card) _____________________
Expiration date____
Signature
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Credit Card billing address (if different than above):
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☐ Wire transfer from bank --- Go to info@epced.com and request banking instructions.

This registration can be sent as an e-mail attachment to info@epced.com. If you prefer not to e-mail your credit information, submit this form without it and call 603-742-3370 to complete your registration.

This registration form may serve as an invoice for those who register.