Hybrid Latex Systems – PU/Acrylic, Alkyd/Acrylic and Inorganic/Organic Latices

Day 1

AM:
- Basics of emulsion polymerization
- Particle size control
- Copolymer composition control
- Colloidal stability
- Dispersion rheology
- Mini-emulsion polymerization techniques
- Introduction to Pickering Emulsions
- Characterization of latices and other dispersions

PM: Organic/inorganic hybrid particles
- Why incorporate inorganics into latex particles?
- Morphological control (thermodynamic vs. kinetic)
- 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
- 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

AM: 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 Hybrid Latex
  - Hydrophobicity of alkyd precludes its use in traditional emulsion polymerization
  - Miniemulsion polymerization
    - applicability to this system and typical procedures
- 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
- 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
PM: 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

- PU/Ac hybrid latex particles
  - Driving force
  - Types of acrylics of interest
  - Morphological alternatives
    - Thermodynamic control’
    - Kinetic control
  - Polymerization processes
    - PUD as “seed” particles, pH control
    - Batch and semi-batch acrylic polymerization
    - Reaction kinetics, including starve fed
      - Initiator systems
      - Reaction temperature ranges
    - 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