Speaker Detail

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Audiovisual Needs	2x2 slide projector overhead projector
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Talks

- **A Better Way to Heat or Cool Your Home or Workplace: Use of Repairable Surfactants as Friction Reducing Additives for District Heating or Cooling Systems**

Piping networks that circulate water to buildings to provide or to remove heat are called district heating or district cooling systems. Using waste heat from utilities or cogeneration systems or a large central chiller, they increase the efficiency of fuel sources, reduce air pollution, and reduce the need to build new power plants to meet peak load conditions. A major operating expense in these circulation systems is the cost of pumping the recirculating water. The addition of small amounts of friction or drag reducing self-assembling surfactant additives which form thread-like network nanostructures which can reduce pressure losses in turbulent pipe flow Pumping power costs can be reduced by up to 90% or the size of pumps, pipes, and fittings can be reduced. The effects of variation in the chemical structures of cationic surfactants and their counterion molecules and also of zwitterionic structures on their drag- reducing effectiveness, their rheology, and their micelle structures and nanostructures will be discussed. Flow measurements, rheological studies, NMR spectra, SANS, and cryo-transmission electron microscopy techniques (cryo-TEM) have been utilized to study the influence of chemical structure on micellar size and shape and nanostructure and on temperature ranges of effectiveness of friction reduction. Some surprising surfactant structures and behaviors will be shown along with the promising results of field tests in district heating systems. Audience Levels Chemists, Chemical Engineers, Students, Environmentalists

- **A Better Way to Heat or Cool Your Home or Workplace: Use of Repairable Surfactants as Friction Reducing Additives for District Heating or Cooling Systems**

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and behaviors will be shown along with the promising results of field tests in district heating systems. Audience Level Chemists, Chemical Engineers, Environmentalist,Students, Categories Energy, Physical Chemistry,Colloid Chemistry

- **Effects of Polymer Characteristics on Friction Reduction in Turbulent Flow of Dilute Polymer Solutions**

The presence of small amounts of high polymers markedly reduces the frictional losses of fluids in turbulent flow through conduits. Pressure drop reductions of over 75 percent have been reported at polymer concentrations of a few parts per million. This phenomenon is called friction reduction or drag reduction. Friction-reducing additives are used in crude oil and finished petroleum product transport, in petroleum fracturing operations, and in fire fighting and have potential applications in storm sewers, in reducing drag on ship hulls, in blood flow, and in anti-misting. In the 48-inch diameter Alaska pipeline, crude oil throughput has been increased by up to 25 percent without changing pumps. The use of polymer additives adds over a billion dollars a year in incremental value to the Alaskan crude throughput. The effectiveness of polymer additives is dependent on their concentration, molecular weight, and chemical structure and on the nature of the solvent. Polymer solution characteristics that favor drag reduction will be reviewed in terms of possible mechanisms for drag reduction. The problem of mechanical degradation of the high polymer molecules will also be discussed.

- **Effects of Variations in the Chemical Structure of Self-Assembling Surfactants on their Micellar Microstuctures and on their Friction-Reducing and Rheological Behavior**

The addition of self-assembling cationic, nonionic, zwitterionic and anionic surfactants at concentrations of 125 to 5000 ppm in water reduces pressure losses up to 90 percent in turbulent flow in pipes (friction reduction). These additives have great potential for reducing pumping energy losses in recirculation flow applications such as in district heating or district cooling systems, which are used to provide heating and cooling for whole districts of buildings in many cities in the U.S., Canada, Europe, and Asia. The effects of variations in the chemical structures of cationic surfactants and their counterion molecules on their drag-reducing effectiveness, their rheology, and their micelle structures and nanoostructures will be discussed. Results of pipe flow, normal stress, extensional viscosity, flow birefringence, and other rheological measurements; NMR spectra; and Cryo-TEM electron microscopy images will be shown to demonstrate how changes in surfactant chemical structure affect micellar shape and nanostructure, rheological behavior, and friction or drag reduction effectiveness. Some surprising surfactant structures and behavior will be shown. The promising results of field tests in several district heating systems will also be described. Audience Level Chemists, Colloid Chemists, Chemical Engineers, Environmentalists Students, Categories Energy Physical Chemistry, Chemical Engineering

- **Friction Reduction in Pipelines: How High Polymer Additives Reduce Energy Losses in Crude Oil Pipelines**

The presence of small amounts of high polymers markedly reduces the friction losses of fluids pumped in turbulent flow through conduits. Pressure drop reductions of over 80 percent have been reported at polymer concentrations of a few parts per million. This phenomenon is called friction reduction or drag reduction. Friction-reducing additives are used in crude oil and finished petroleum product transport, in petroleum fracturing operations, and in fire fighting and have potential applications in storm sewers, in reducing drag on ship hulls, in jet cutting, in blood flow, and in anti-misting of jet fuels. In the 48-inch diameter Alaska pipeline, crude oil throughput was increased by up to 25 percent without changing pumps, adding over a billion dollars a year in incremental value to Alaskan crude throughput. The effectiveness of polymer additives depends on their chemical structure, concentration and molecular weight and on the nature of the solvent. Polymer solution characteristics that favor drag reduction will be reviewed in terms of possible mechanisms for drag reduction. Variables affecting mechanical degradation of high polymer molecules will also be discussed. Audience Levels Chemists, Chemical Engineers, Students, Environmentalists Categories Physical Chemistry Polymer Chemistry Colloid Chemistry Chemical Engineering

- **Some Strange Flow Phenomena of Rheologically Complex Fluids**

Polymers, surfactants, and other additives impart elastic properties to their solutions, resulting in unusual flow characteristics of their solutions. Most common are the climbing effect up the stirrer of food mixes, cake batter, and polymer solutions in mixing operations and jet swelling of extruded polymers. Unusual behavior of polymer and surfactant solutions in laminar and turbulent jets and flow through porous media are also observed. Turbulent drag reduction and vortex inhibition are other surprising phenomena of these solutions. The strange phenomena to be discussed range from the effects of polymer additives in promoting anti-misting behavior in jet fuels to reduce the dangerous fireball hazard, to the tubless siphon, to their effects on arterial blood flow plaque deposits in the arteries of rabbits and pigeons. Audience Levels: Chemists, Chemical Engineers, Students, Polymer scientists, Environmentalists Categories Physical Chemistry Polymer Chemistry. Colloid Chemistry Chemical Engineering, Rheology Categories Energy, Physical Chemistry,Polymer Chemistry and Polymer Physics

Biographical Information

Biographical Sketch

Jacques L. Zakin, Helen C. Kurtz Professor Emeritus of Chemical Engineering at The Ohio State University, has for many years been interested in the rheology of dilute polymer solutions, dilute surfactant solutions, and other fluids with similar properties. His other interests include surfactant microstructures, drag reduction, structure of turbulence, mechanical degradation, and generalized viscosity-concentration relations. He has also worked on the problems associated with transport in pipelines of viscous crude oils as oil-in-water emulsions. Prior to coming to Ohio State in 1977, where he was Department Chair from 1977 to 1994, he taught at the University of Missouri-Rolla for 15 years with sabbaticals at the Technion and the Naval Research Laboratory. Earlier he did lubricant research and development at the Socony Mobil Research Laboratories. In 1994-95, he held a Senior Fulbright Research Fellowship at the Technion. Dr. Zakin received his three degrees in chemical engineering at Cornell, Columbia, and New York Universities.