2006 ACS Award in Applied Polymer Science

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Christopher K. Ober, Francis Norwood Bard Professor of Materials Engineering at Cornell University, is honored for his extraordinary ability to craft unique polymer architectures having practical applications in solving timely and important environmental, microelectronic, and biological problems.

Born in 1954, Ober received his B.Sc. degree in chemistry from the University of Waterloo, Ontario, in 1978 and his Ph.D. from the University of Massachusetts, Amherst, in 1982, for his research on the synthesis and characterization of liquid-crystalline polyesters based upon *p*-hydroxybenzoic acid. From 1984 to 1986, he was a senior member of the research staff at Xerox Research Centre of Canada, in Mississauga, Ontario, where he received the 1984 Xerox Award for Creative Invention for studies of dispersion polymerization and the invention of "one-pot toner."

"I was involved as a graduate student in very early research in liquid-crystalline polymers," he says. "While at Xerox, I discovered a new variant of dispersion polymerization that enabled formation of large, monodisperse polymer microparticles."
Ober moved to Cornell as an assistant professor in 1986 and established a large and well-funded polymer research group. His current research interests focus on the synthesis, processing, and characterization of functional polymers with tailored molecular architectures for predefined properties.

"We are particularly interested in systems that undergo 'bottom-up' self-organization, including liquid-crystalline polymers and block copolymers, and 'top-down' lithographic processing," he notes.

In recent work, he has developed water-developable fluoropolymer resists for a new generation of photolithographic tools that can be patterned to form features as small as 100 nm. Ober has also pioneered the use of supercritical carbon dioxide as an environmentally friendly lithographic developer that overcomes the problems of poor solubility of fluoropolymers and pattern collapse in aqueous developers.

In other work, Ober has incorporated semifluorinated liquid-crystalline side chains into polymers to produce materials with a high surface density of CF_3 groups. The materials resist surface reconstruction because of the thermodynamic barrier to rearrangement presented by the mesophase. He has used synchrotron-based, near-edge X-ray-absorption fine-structure spectroscopy, atomic force microscopy, and other techniques to establish the extremely high surface ordering present in semifluorinated liquid-crystalline polymers. The materials are nontoxic and exhibit properties that make them suitable, for example, as coatings that resist biofouling in a marine environment. The U.S. Navy is testing protective films made of these liquid-crystalline fluoropolymers.

Ober has also developed "reworkable" epoxy-based thermoset composites. The thermoset networks contain weak links so that the material can be broken down by moderate heating and recycled. The "reworkable" materials are being developed commercially as adhesives for microchips, so that defective parts can be reprocessed. The materials are expected to find applications in the computer and telecommunications industries.

An author or coauthor of more than 30 patents and more than 300 research publications, Ober has received numerous honors and awards. In 1996, for example, he received the National Science Foundation Award for Creative Research for his work on liquid-crystalline polymers. In 2004, he received Japan's Photopolymer Science & Technology Award.

Ober was chair of the ACS Division of Polymeric Materials: Science & Engineering in 2000 and is currently an alternate councilor for the division. He is also associate editor of *Macromolecules*, vice president of the Polymer Division of the International Union of Pure & Applied Chemistry, and a member of the advisory council of the Max Planck Institute for Polymer Research in Mainz, Germany.

The award address will be presented before the Division of Polymeric Materials: Science & Engineering.-Michael Freemantle