Jennifer A. Lewis named 2012 MRS Medalist for direct-write assembly of soft functional materials

The Materials Research Society has named Jennifer A. Lewis, the Hans Thurnauer Professor of Materials Science and Engineering and director of the Frederick Seitz Materials Research Laboratory at the University of Illinois at Urbana-Champaign (UIUC), as an MRS Medalist. She was cited for "pioneering contributions in the design of viscoelastic inks composed of colloidal, polymeric, and organometallic building blocks and their directed assembly into planar and 3D functional architectures." Lewis will be recognized during the awards ceremony at the 2012 MRS Fall Meeting in Boston, where she will also give an award talk.

In the past 10 years, Lewis, an MRS fellow and the first woman to receive an MRS Medal, has made major contributions in the areas of direct-write assembly of soft functional materials and the design of complex fluids with tunable phase behavior, structure, and rheological properties. In the first area, Lewis has developed entirely new ways to assemble two- and three-dimensional micro- and nanostructures based on direct writing of functional inks. She optimized their viscoelastic response to enable the inks to flow when delivered through fine deposition nozzles, yet solidify upon exiting the nozzles. In this way, she is able to "write" 3D structures directly, with micron-resolution, and overall dimensions that range from 10s of microns to 1 m.

To date, Lewis has created colloidal, fugitive organic, polyelectrolyte, hydrogel and sol-gel inks for printed electronics, lightweight architectures, and tissue engineering scaffolds. For example, she recently extended the capabilities of 3D printing through the development of concentrated silver nanoparticle inks, which enable omnidirectional printing of flexible, stretchable, and spanning microelectrodes for electronic and optoelectronic devices. In addition to printing out-of-plane architectures, Lewis demonstrated strategies for folding, wrapping, and mechanically manipulating printed mesh structures in a process that she refers to as printed origami. To enable this type of approach, she introduced new classes of colloidal inks for printing into planar scaffolds that can then be folded and bent, akin to wet-folding origami, without cracking or forming other defects. By integrating these two approaches, 3D structures can be created that would be impossible to fabricate by other means. Although much of Lewis's work focuses on colloidal-based materials, the techniques can be used with many other systems.

These successful ink designs require deep fundamental understanding of the phase behavior, structure, and rheological properties of complex fluids. More broadly, Lewis made several important foundational contributions, most significantly in the areas of colloidal stabilization and assembly. Roughly a decade ago, she discovered a new colloidal stabilization mechanism known as nanoparticle haloing, which arises in binary mixtures composed of negligibly charged microspheres and highly charged nanoparticles. She then used these novel mixtures to assemble colloidal crystals via an epitaxial templating approach and, more recently, to create patterned colloidal films by evaporative lithography.

Lewis received a BS degree with honors from the University of Illinois (1986) and an ScD degree from the Massachusetts Institute of Technology (1991) and joined the faculty of UIUC in fall 1990. She has over 150 publications and eight US patents. Her honors include NSF Presidential Faculty Fellow Award (1994); Brunauer Award (2003) from the American Ceramic Society; Langmuir Lecture Award, American Chemical Society (2009); and Fellow of the American Academy of Arts and Sciences (2012).

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