Janus particles offer new physics, new technology

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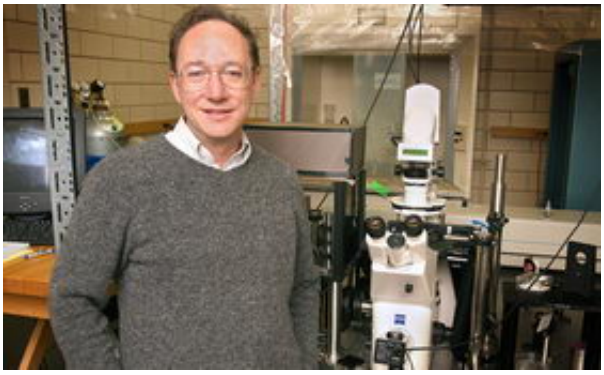

Steve Granick, a professor of materials science and engineering, of chemistry and of physics, has modified the surface of colloidal particles into a Janus chemical compound. "We can measure the rotational dynamics of single colloidal particles in suspension as well as at interfaces," Granick said. "We can also take advantage of the particles' two very dissimilar sides to create families of microsensors." University of Illinois Photo

In Roman mythology, Janus was the god of change and transition, often portrayed with two faces gazing in opposite directions. At the University of Illinois at Urbana-Champaign, Janus particles are providing insight into the movement of molecules, and serving as the basis for new materials and sensors.

"By modifying the surface of colloidal particles into a Janus chemical compound, we can measure the rotational dynamics of single colloidal

particles in suspension as well as at interfaces," said Steve Granick, a professor of materials science and engineering, chemistry and physics. "We can also take advantage of the particles' two very dissimilar sides to create families of microsensors."

Using a metal-deposition technique, Granick and his research team – graduate students Liang Hong and Steven Anthony, and postdoctoral research associate Huilin Tu – make particles half-covered by metal, and generate geometrically symmetric but chemically asymmetric materials. Trapped inside the micron-size particles are fluorescent dyes, which can only be seen through the uncoated hemisphere, not through the metal-coated hemisphere.

"Because these colloidal particles are rotating, they twinkle as they move back and forth, 'swimming' by Brownian motion," said Granick, who is also a researcher at the Frederick Seitz Materials Research Laboratory and at the Beckman Institute for Advanced Science and Technology. "By carefully monitoring the motion of the particles, we can now ask questions about that motion that were not possible before."

Individual particles can be tied together like strings of pearls. Using precision imaging and tracking techniques, the researchers can measure the movement as the strings tumble around. The particles can also be used as microprobes and microrheometers.

"We are continuing to explore the chemical modification of the metal surface to form new colloid-based materials," said Granick, who will describe his team's work at the March Meeting of the American Physical Society, to be held at the Baltimore Convention Center, March 13-17. "We are also investigating the use of electrical fields and magnetic fields to manipulate the particles."

Source: University of Illinois at Urbana-Champaign