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Getting $1.5 Million More for MCC Money

Santa Barbara, Calif. -- A University of California program--UC-SMART--designed to enhance industrial research support through matching funds, announced in July its decision to provide about $1.5 million to fund the proposal "Design and Manufacturing of Materials and Devices for Optical and Electronic Applications." The four research projects that are the focus of that proposal are being conducted under the auspices of the five-year, $15 million research alliance between UCSB and Mitsubishi Chemical Corp. (MCC), established last February.

UC-SMART, which stands for "University of California Semiconductor Manufacturing Alliance for Research and Training," will allocate its matching funds over a four-year period.

UCSB Chemical Engineering Professor Glenn Fredrickson, director of the Mitsubishi Chemical Center for Advanced Materials (MC-CAM) and principal investigator for the UC-SMART proposal, said, "The beauty is that we can leverage the research support from Mitsubishi Chemical with UC-SMART funds to increase overall support for the research programs of MC-CAM. Mitsubishi Chemical benefits from access to technologies created by a larger UCSB research effort; the State of California and UCSB benefit from job creation and income accrued from MCC's commercialization of these technologies through its California subsidiary, MC-Research and Innovation Center. This is truly a win-win situation!"

Detailed below, the four projects for which UC-SMART provided matching funds all "invoke the common theme of using nano- and micron-scale self assembly processes to create novel structured materials for electronic and photonic device applications," according to the proposal.

Organic Chromophores. These molecules are capable of absorbing light in special ways, notably "TPA" or two-photon absorption. The key idea is to do something with that absorbed energy either locally (within the molecule) or contextually (in the molecule's environment). An example of a local use is "writing," as in three-dimensional optical media storage or holograms. Contextually, the energy could be used to initiate, for instance, polymerization. Teaming up on this research are chemists Guillermo Bazan and Galen Stucky and chemical engineer Brad Chmelka.

Nanoparticle Patterning. Two engineering professors, Ed Kramer and Pierre Petroff, working, respectively, in the seemingly disparate areas of soft and hard materials are partnered in an effort to use block co-polymers to place nano-sized particles on a regular lattice, and thereby pioneer a new technique for nanoscale semiconductor device construction. Kramer brings to the collaboration his methods for initiating self-assembly of thin film block co-polymers into miniscule spheres (30 nanometer diameter), which then form into a perfect hexagonal lattice about one micron across. Petroff holds the patent for the one-dimensional semiconductor quantum dot. The idea is to locate nano-sized semiconductor particles inside the block co-polymer spheres and thereby organize the inorganic nanoparticles on a regular lattice. This research holds the promise of a new fabrication technique, as well as new devices.

Self-Assembled Photonic Materials and Devices. The past and present chairs of Chemical Engineering, Fredrickson and David Pine, are collaborating on the development of new inorganic particles that are very efficient at scattering light. Particles of titanium are widely used in white paint because they reflect light so well. This collaboration is trying to engineer a titanium sphere, 10 microns wide, which is highly filled with smaller one-micron spherical voids. According to Fredrickson, "If we can adjust the size and packing of the little spheres just right, we can make an overall particle that looks and behaves like a small piece of a photonic crystal. We will then have made a titanium particle that can scatter light better than any known particle. And we will use less material to do better the job of scattering light." Not only do Pine and Fredrickson have their eyes on more cost-effective coatings, but on a light diffuser particularly well-suited to solid state lighting devices.

Better Conducting Polymers. Physicist Alan Heeger, winner of the 2000 Nobel Prize in Chemistry for the discovery of conducting polymers, is engaged in research to make them better--with higher mechanical strength and higher electrical conductivity. So far, most conducting polymers have proved to be impracticably sensitive to their environments. According to condensed matter theory, aligned polymer chains can exhibit high conductivity. The question is how to turn that theoretical possibility into reality. The challenge is akin to figuring out how to get strands of wiggling spaghetti to line up side by side.

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