Final year for Iowa NASA EPSCoR project on new class of polymer matrix composites

Principal investigator is Michael Kessler, Iowa State University associate professor of materials science and engineering. Co-investigators are Xiaoli Tan and Nicola Bowler, both from the Materials Science and Engineering Department at ISU, and Olesya Zhupanska from the Mechanical and Industrial Engineering Department at the University of Iowa. Seven graduate students, five undergraduate students and two postdoctoral associates from Iowa State and University of Iowa have also worked on the project over the last three years.

The researchers are now in the final year of a three-year grant funded by Iowa NASA EPSCoR to design and evaluate a new class of polymer matrix composites for multifunctional applications, such as structural capacitors and damage or deformation sensors. The group's technical objectives have been as follows:

- Engineer and optimize, simultaneously, disparate material properties such as structural and electromagnetic properties.
- Achieve energy storage and structural efficiencies resulting in net mass reduction compared with systems with separate energy storage and structural components.

Their recent work, published in the journal *Composites Science and Technology*, the leading journal in the field of composite materials, describes polymer matrix composites (PMCs) with dispersed Si nanoparticles and their dielectric and mechanical properties. It was found that Si nanofillers significantly enhance the dielectric constant of the nanocomposites while preserving the low loss tangent of the cyanate ester matrix. Meanwhile, incorporation of Si nanoparticles effectively stiffens the polymer, as manifested by the large increase in the storage modulus. Furthermore, the conductivity of the composite was observed to decrease under compressive mechanical stresses due to the piezoresistive effect of Si. Therefore, these novel Si/BECy nanocomposites simultaneously display mechanical load-carrying, electric energy-storing and stress-sensing capabilities, very promising for multifunctional devices such as structural capacitors.

Sharron Quisenberry, vice president for research and economic development at Iowa State University and ISU presidential representative, presents the Iowa Space Grant Consortium Research Recognition Award to Michael Kessler at the Consortium's annual meeting in Marshalltown.

Kessler was presented with the Iowa Space Grant Consortium Research Recognition Award at the Consortium's annual meeting in July 2012.

Iowa NASA EPSCoR travel grants strengthen ties to NASA Centers

This academic year Iowa NASA EPSCoR solicited proposals to support travel to NASA centers for researchers to strengthen relationships with NASA scientists or other collaborators, discuss specific concept proposals with NASA or other future funding sources, and/or attend important technical conferences to network with possible collaborators. Eleven grants of a maximum of $2,000 each were awarded, as follows:

Drake University

Timothy Urness, *Mathematics and Computer Science: travel grant for Urness and* **Dr. Charles Nelson** *to visit the Space Telescope Science Institute in Baltimore to work with* **Dr. Gary Bower**

Their project is to develop and utilize data visualization techniques to understand the kinematics of ionized gas in the nuclear regions of Seyfert galaxies. The ultimate goal is to compare spectroscopic analysis results with the expectations from various gas flow models to determine the dominant acceleration mechanism.

Iowa State University

Diane Debinski, *Ecology, Evolution and Organismal Biology: travel to Goddard Space Flight Center*

Debinski gave a seminar to scientists in the Earth Sciences Division at Goddard on linking field research with spectral data to quantify interannual variation in productivity and phenology in grassland communities. The visit enabled her to examine the potential for collaborations with NASA scientists, which will be a component of an Iowa NASA EPSCoR research proposal she will submit in the fall.

Brian Hornbuckle, *Agronomy: travel to attend the American Geophysical Union Chapman Conference on Remote Sensing of the Terrestrial Water Cycle in Kona, Hawaii*

Hornbuckle organized a meeting of scientists from ISU, UI and the USDA ARS to discuss how they can work together and with two new NASA satellite missions, both scheduled for a 2014 launch. The Global Precipitation Mission Core Observatory is

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