SUSTAINABILITY

Producing Organic Photovoltaics

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Long before the Gulf oil spill and President Obama's call for new efforts to reduce U.S. dependence on oil, Columbia researchers were working to reduce our dependence on the world's rapidly dwindling supply of fossil fuels. Ioannis (John) Kymissis and his team are working on producing organic photovoltaics that are easier and cheaper to manufacture than solar cells currently on the market.

Photovoltaics, which convert energy from the sun into electricity, have been around for more than 50 years. They are currently used in a variety of applications, such as roadside emergency telephones and traffic signs, and recharging batteries in remotely deployed electronics. Such installations potentially present a number of grid-level advantages in both advanced and developing economies. Distributed power generation through photovoltaics can reduce the load on strained distribution systems and provide power to remote locations where it may be cost-prohibitive or environmentally problematic to run power lines.

The rate of photovoltaic production has been increasing rapidly—more than 50 percent per year—but photovoltaics are still dwarfed by other sources of energy. Kymissis notes that photovoltaics produced only 0.02 percent of the total energy used in the United States last year; a new approach to photovoltaics is required to meet global energy needs.

Kymissis' team is involved in improving the performance and processability of photovoltaics using organic thin-film semiconductor materials that are elementally abundant, inexpensive to synthesize, and straightforward to deposit in large installations. The team is working on how to improve efficiency, reduce processing costs, improve storage lifetime, and increase the operating lifetime of organic photovoltaic devices.

Kymissis believes that thin-film semiconductors, with their ability to scale to large sizes, can solve a variety of sensing and power conversion problems. His group can fabricate systems that integrate a variety of thin-film devices, including photovoltaics and organic photodetectors, organic field effect transistors, piezoelectric polymer sensors, and organic light-emitting diodes. These integrated devices can be applied to applications in which electronics need to interface with large objects in the real world, such as sensors that can measure sound and airflow over an airplane wing.

"Our children will see the end of petroleum and our grandchildren will see the end of coal," said Kymissis. "It's essential that we start working today to reduce our dependence on finite energy resources to insure a better standard of living for future generations than we have today."

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