ENERGY FOCUS

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Optical nanoantenna, photodiode combined in same structure

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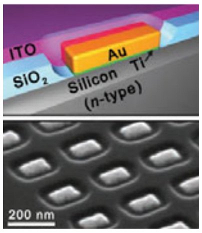
Rice University researchers led by Naomi Halas reported on an active optical nanoantenna device that uses energetic or "hot" electron–hole pairs arising from plasmon decay to directly generate a photocurrent, resulting in the detection of light. They achieved this by attaching a metal nanoantenna specially tuned to interact with infrared light to silicon. Two independent functions, light harvesting and photodetection, have thus been combined in the same structure. Lead author Mark Knight patterned gold nanorod arrays as nanoantennas directly onto a Si surface to create a Schottky barrier. Light striking the antenna generated electron–hole pairs resulting in "hot" electrons that jumped the barrier into the semiconductor, creating an electrical current. "We're merging the optics of nanoscale antennas with the electronics of semiconductors," said Halas. "There's no practical way to directly detect infrared light with silicon, but we've shown that it is possible if you marry the semiconductor to a nanoantenna."



Ultrathin transparent Au electrodes for organic photovoltaics fabricated

Advanced Functional Materials DOI: 10.1002/adfm.201002021

Researchers at the University of Warwick have reported the development of a solvent-free method for fabricating highly transparent ultrathin gold films on glass as the transparent electrode for organic solar cells. With a gold layer thickness of only 8 nm, the current cost of gold to manufacture a 1 m^2 window is about $7.40. Ultrathin stable metal films such as gold are an alternative to the increasingly rare indium tin oxide commonly used as a transparent electrode, but until now, it has not been possible to deposit a gold film sufficiently thin to be transparent without being too fragile and electrically resistive to be useful. Researchers Ross Hatton and Tim Jones have developed a rapid method for the preparation of robust, ultrathin gold films on glass. The crucial step is derivatizing the glass surface with a mixed monolayer of 3-mercaptopropyl(trimethoxysilane) and 3-aminopropyl(trimethoxysilane) through co-deposition from the vapor phase, prior to Au deposition by thermal evaporation. "This new method of creating gold-based transparent electrodes is potentially widely applicable for a variety of large area applications, such as in organic optoelectronics and the emerging fields of nanoelectronics and nanophotonics," Hatton said.

Polymer structures designed for use as "plastic electronics"

Physical Chemistry Chemical Physics DOI: 10.1039/C0CP00353K

Malika Jeffries-EL of Iowa State University is trying to teach old polymers new tricks. Her "old polymers" of choice are polybenzobisoxazoles (PBBO), which are well-suited for electronic applications because they efficiently transport electrons, are stable at high temperatures, and can easily absorb photons. The "new tricks" involve incorporating the benzobisoxazole (BBO) moiety into electron donating–accepting polymer architectures to take advantage of its high electron affinity. The use of PBBOs has been limited due to their poor solubility, necessitating harsh reaction conditions for synthesis. Jeffries-EL and her colleagues have developed an alternative approach toward BBO synthesis using mild conditions. They reported the synthesis of two solution processible, conjugated thiophene-BBO copolymers. While devices based on blends of these copolymers with other organic molecules yielded modest power conversion efficiencies, the flexibility of synthesizing these materials to tune the properties is promising. The advantageous electronic properties and reversible electrochemistry of these polymers suggest that BBOs are useful building blocks for the synthesis of conjugated polymers that could be very useful in organic solar cells, light-emitting diodes, and thin-film transistors.

Smart Grid Panel agrees on standards for meter upgrades and wireless communication

The governing board of the Smart Grid Interoperability Panel (SGIP), a group of public and private organizations in the United States created by the National Institute of Standards and Technology (NIST) to coordinate development of consensus-based Smart Grid standards, has voted in favor of a new standard and a set of guidelines important for making the long-planned "smart" electricity grid a reality. The two documents are called "Priority Action Plans," or PAPs, and they describe critical needs for realizing an energy-efficient, modern power grid with seamlessly interoperable parts. The "Meter Upgradeability Standard" (PAP 0) is designed to ensure that the new generation of smart electricity meters does not become obsolete. The "Guidelines for Assessing Wireless Communications for Smart Grid Applications" (PAP 2) covers standards necessary for wireless communications between all devices connected to the Smart Grid. □