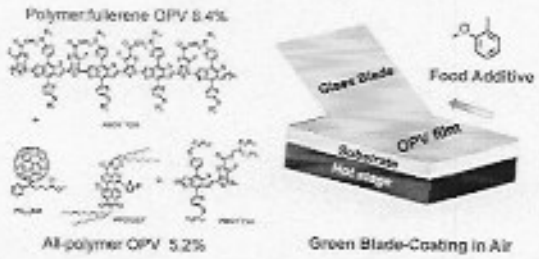
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Food additive key to environmentally friendly, efficient, plastic solar cells

29 September 2016, by Tracey Peake



Schematic illustration and chemical structure of semi-printed plastic solar cells in air, using food additive o-MA as solvent. Image credit: Long Ye, NC State

Researchers from North Carolina State University and the Chinese Academy of Sciences have created an efficient, semi-printed plastic solar cell without the use of environmentally hazardous halogen solvents. These solar cells can be manufactured at room temperature, which has implications for large-scale commercial production.

Plastic solar cells, or organic photovoltaics, are popular because they are lightweight, flexible, transparent and inexpensive to manufacture, making them useful in multiple applications. Unfortunately, the halogen-containing solvents used in their manufacture are an obstacle to large-scale commercialization. These solvents are key to making sure that the solar cell's morphology, or structure, maximizes its energy efficiency; however, they are environmentally hazardous. Additionally, the use of these harsh chemicals requires a controlled environment, which adds to production costs.

Long Ye, a postdoctoral research scholar in physics at NC State and lead author of a paper describing the work, wanted to find out if nontoxic solvents could provide equally efficient morphology in the manufacturing process. Ye and his colleagues developed a proof of concept semi-printed plastic solar cell that utilized o-methylanisole (o-MA) as the solvent. O-MA is a commonly used flavoring agent in foods, and is nontoxic to humans.

The researchers used soft X-ray techniques to study the morphology of their solar cell. They found that the o-MA based solar cell had similar morphology, crystalline features and device performance to those produced by halogenated solvents. The solar cell's overall efficiency rating was around 8.4 percent. Furthermore, their cell could be produced via blade coating at ambient, or room temperature. Blade coating is a process that uses a glass blade to spread a thin layer of the photovoltaic film onto either a rigid or flexible substrate, and the process is compatible with large-scale commercial manufacturing.

"Two of the key requirements for mass producing these solar cells are that the cells can be produced in the open air environment and that the process doesn't pose health or environmental hazards," Ye says. "Hopefully this work can help pave the way for printing solar cells in ambient air."

The work appears in *Chemistry of Materials*.

More information: Long Ye et al. High Performance Organic Solar Cells Processed by Blade Coating in Air from a Benign Food Additive Solution, *Chemistry of Materials* (2016). DOI: 10.1021/acs.chemmater.6b03083

Provided by North Carolina State University

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Creating new devices that emulate human biological synapses

29 September 2016, by Patrick J. Callahan

Engineers at the University of Massachusetts Amherst are leading a research team that is developing a new type of nanodevice for computer microprocessors that can mimic the functioning of a biological synapse—the place where a signal passes from one nerve cell to another in the body. The work is featured in the advance online publication of *Nature Materials*.

Such neuromorphic computing in which microprocessors are configured more like human brains is one of the most promising transformative computing technologies currently under study.

J. Joshua Yang and Qiangfei Xia are professors in the electrical and computer engineering department in the UMass Amherst College of Engineering. Yang describes the research as part of collaborative work on a new type of memristive device.

Memristive devices are electrical resistance switches that can alter their resistance based on the history of applied voltage and current. These devices can store and process information and offer several key performance characteristics that exceed conventional integrated circuit technology.

"Memristors have become a leading candidate to enable neuromorphic computing by reproducing the functions in biological synapses and neurons in a neural network system, while providing advantages in energy and size," the researchers say.

Neuromorphic computing—meaning microprocessors configured more like human brains than like traditional computer chips—is one of the most promising transformative computing technologies currently under intensive study. Xia says, "This work opens a new avenue of neuromorphic computing hardware based on memristors."

They say that most previous work in this field with memristors has not implemented diffusive dynamics without using large standard technology found in integrated circuits commonly used in microprocessors, microcontrollers, static random access memory and other digital logic circuits.

The researchers say they proposed and demonstrated a bio-inspired solution to the diffusive dynamics that is fundamentally different from the standard technology for integrated circuits while sharing great similarities with synapses. They say, "Specifically, we developed a diffusive-type memristor where diffusion of atoms offers a similar dynamics and the needed time-scales as its bio-counterpart, leading to a more faithful emulation of actual synapses, i.e., a true synaptic emulator."

The researchers say, "The results here provide an encouraging pathway toward synaptic emulation using diffusive memristors for neuromorphic computing."

The title of the article is "Memristors with diffusive dynamics as synaptic emulators for neuromorphic computing."

More information: Zhongrui Wang et al. Memristors with diffusive dynamics as synaptic emulators for neuromorphic computing, *Nature Materials* (2016). DOI: 10.1038/nmat4756

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