

Louisiana Tech researchers design, fabricate innovative energy harvesting device

EurekAlert

RUSTON, La. — Dr. Long Que, assistant professor of electrical engineering at Louisiana Tech University, has reported success in designing and fabricating a device that allows microscale electronic devices to harvest their own wasted energy.

The work was described in a paper published in the September edition of *Applied Physics Letters* and has also caught the attention of PhysOrg.com, a website that features breakthroughs in science and technology from all over the world.

The paper titled, "Light and thermal energy cell based on carbon nanotube films" and co-authored by students Pushparaj Pathak, Tianhua Zhang, Yuan He, and Shashi Yadav, was accepted for publication in *Applied Physics Letter* less than a month after its initial submission.

Developed at Louisiana Tech and described in the paper, this technology uses a cantilever made out of piezoelectric material — material capable of converting distortions to itself into electrical energy — and is coated with a carbon nanotube film on one side. When the film absorbs light and/or thermal energy, it causes the cantilever to bend back and forth repeatedly, which causes the piezoelectric material to generate power as long as the light and/or heat source is active.

Through cyclical bending activity, the device would essentially allow small electronic devices to harvest their own operational energy.

"The greatest significance of this work is that it offers us a new option to continuously harvest both solar and thermal energy on a single chip, given the self-reciprocating characteristics of the device upon exposure to light and/or thermal radiation," said Que. "This characteristic might enable us to make perpetual micro/nano devices and micro/nanosystems, and could significantly impact the wireless sensory network."

In their experiments, Que's research team showed that the device could generate enough power to adequately operate some low-power microsensors and integrated sensors. One of the most unique and innovative aspects of this energy harvesting system is its ability to "self-reciprocate" — the perpetual production of energy without needing to consume other external energy sources.

The researchers state that the self-reciprocation occurs from the cantilever's constant absorption of photons and its high electrical conduction and rapid thermal dissipation into the environment. The self-reciprocation phenomenon has been routinely observed, not only in the lab, but also in the field under sunlight. This

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technology can also harvest different types of energies such as vibrational and wind energies.

"It is truly a hybrid energy-harvesting technology," Que said. "My lab has been optimizing and making great progress on this technology in an effort to enhance its efficiency and overall performance, indicating great promise for this technology."

Que believes that, in the future, the device could be used to power a number of different nano and microsystems such as implanted biomedical devices or remotely located sensors and communication nodes.

One of the comments posted on PhysOrg.com in response to the article says, "This may not sound like much, but it's a significant breakthrough that could well profoundly impact the design of many products. Specifically I'm thinking the design of very small spacecraft and consumer electronics, but this breakthrough isn't limited to those fields (over the very long term, anyway)."

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