Scientist receives grant to develop hydrogen-powered, solar-inspired nano-battery

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There's a big buzz today over future nanostructure devices performing specialized jobs in everything from electronics to medicine. But what's still needed are unconventional ways to power these tiny machines.

Eduard Karpov, University of Illinois at Chicago assistant professor of civil and materials engineering, just received a three-year, $217,000 grant from the National Science Foundation to develop a new battery he is calling a catalothermionic generator.

It will generate power on a flat planar surface, just like in a photovoltaic or solar cell, only instead of sunlight being the energy source, hydrogen oxidation will power the electron flow.

Unlike conventional hydrogen fuel cell technology that has been around for more than a century, this new approach, called "chemovoltaics," harnesses energy from hydrogen oxidation taking place on a film-like catalytic metal surface. Unlike fuel cells, the chemovoltaic device can be very small and flat and does not release or absorb heat, allowing it to run at much cooler temperatures. But like fuel cells, its energy-production byproduct is only water.

"This device is the child of the nanotechnology era," Karpov said. "It consists of nano-thickness layers of catalytic material on top of semiconductor substrates.

"We know the basic physics, but utilizing it for an energy application is a

new idea," he said.

Karpov and his UIC laboratory team will test structural variations for building these nano-sized devices to generate maximum power. They will also test various types of catalytic materials such as platinum, palladium or some oxides to see what works best, vary the thicknesses of the catalytic material to see if that makes a difference, and try various patterned surfaces on the catalyst to learn if this affects performance.

Karpov envisions initial applications for these tiny generators in critical military devices where their small size and low weight will outweigh the high startup costs. As the technology develops, the generator might be attached directly to computer chips as a power source, or to tiny devices such as a nano-robot.

"Our main task is to show that this phenomenon, in principle, can lead to a commercially viable technology that has the potential to compete with fuel cells," he said.

Provided by University of Illinois at Chicago