By switching catalyst from silver to copper, Natcore finds additional solar cell savings

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In making a solar cell, scientists etch nanoscale spikes into a silicon wafer in order to maximize its surface area and consequently to maximize the amount of sunlight to reach it. Metal particles have been used as a catalyst in this process because etching is much accelerated near metal particles.

Initially, gold had been the metal of choice. But at nearly $3,000 per troy ounce, gold is an expensive alternative. And so scientists found a way to switch to silver particles, since silver is much cheaper at around $20 per troy ounce. Even though a very small amount of the catalyst is used to make a single solar cell, the cost saving is significant when building, say, a typical 100MW facility.

But now, scientists working for Natcore Technology Inc. at the Rice University lab of Prof. Andrew Barron, a Natcore co-founder, have successfully used copper as a catalyst. Copper costs about 20 cents per troy ounce, or 1/100th of the cost of silver.

The chemical stew that makes it possible is a mix of copper nitrate, phosphorous acid, hydrogen fluoride and water. When applied to a silicon wafer, the phosphorus acid reduces the copper ions to copper nanoparticles. The nanoparticles aid in removing electrons from the silicon wafer's surface, thereby oxidizing it. The oxidized silicon is dissolved by the hydrogen fluoride, resulting in a process that forges inverted pyramid-shaped structures into the silicon.

The result of fine-tuning the process is a black silicon layer with features as small as 590 nanometers (billionths of a meter) that reflect less than one percent of light. (By comparison, a clean, un-etched silicon wafer reflects nearly 40 percent of light.)

"There are still some challenges to overcome," says Prof. Barron. "The spikes would still require a coating to protect them from the elements, and we're working on ways to shorten the process needed to perform the etching in the lab. We also need to completely remove the copper catalyst in order to extend the life of the solar cell. But this method is far more practical than previous methods," he says

"This is another step in our push to bring down the cost of solar energy and to make it cost-competitive with energy derived from conventional sources," says Chuck Provini, Natcore's president and CEO. "By switching from silver to copper, we'd lower the cost of producing a solar cell by a fraction of a penny. But over the course of a 100 MW facility, that's a saving of more than $100,000."

The research by Barron and Rice graduate student and lead author Yen-Tien Lu appears in the Royal Society of Chemistry's *Journal of Materials Chemistry A*.

Provided by Natcore Technology Inc.

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