

Researchers Developing More Powerful Solar Cells

Sure, Iowa has its share of rainy, snowy and cloudy days. But look out the window. “We have a lot of sunlight,” said Vikram Dalal as sunshine lit up a late-summer morning and the south-facing windows of his office at Iowa State University’s Applied Sciences Complex.

Dalal, the director of Iowa State’s Microelectronics Research Center and the Thomas M. Whitney Professor in electrical and computer engineering, has spent more than three decades finding ways for that sunlight to generate more and more electricity. He thinks his latest project can boost the performance of an Iowa company’s solar cells by 40 to 50 percent.

Dalal is working with PowerFilm Inc., an Ames company that manufactures thin, flexible solar panels, to improve the performance and stability of the company’s solar cells. The project is partially supported by a \$63,406 grant from the Grow Iowa Values Fund, a state economic development program. Dalal also has a three-year, \$220,000 grant from the National Science Foundation to support a separate but similar research project.

One of the challenges facing solar cell manufacturers is the fact that most cells are manufactured with crystalline silicon, the same material that’s used to make computer semiconductors. Because computer parts have so much more value than solar cells, Dalal said there’s a shortage of silicon for solar cells.

There is, however, a way to manufacture solar cells using a lot less silicon. Dalal said non-crystalline silicon wafers that are about 2 micrometers thick can replace crystalline wafers that are about 300 micrometers thick. The result is thin solar cells that can absorb lots of light and can be mounted on flexible plastic and other materials. It’s the kind of solar cell technology produced by PowerFilm Inc. But the thin cells produce about half the electricity as crystalline silicon. And their performance drops by about another 15 to 20 percent over time.

“That’s where we come in,” Dalal said.

Iowa State researchers have made discoveries in materials science and plasma chemistry that can improve hydrogen bonding to the silicon in the thin solar cells. And Dalal said that can improve the performance of the cells by about 35 percent and eliminate about 15 percent of the drop in performance.

The discoveries are expected to result in several patents, Dalal said.

They’re also expected to be a potential boost to PowerFilm. Dalal said the new techniques should work with essentially the same manufacturing processes and equipment now used by PowerFilm.

Frank Jeffrey, the chief executive officer of PowerFilm, said he’d be happy to see the performance of his company’s solar cells jump by even 20 percent.

“It would put us in a much stronger competitive position,” Jeffrey said. “If we can increase performance and keep costs in line, that would give us a significant advantage over other people pursuing thin film solar technology right now.”

But he acknowledges Dalal’s project won’t be an easy one.

“It is a significant challenge to get the advancement he’d like to make,” Jeffrey said.

But Dalal is looking forward to facing those challenges in his laboratory.

“This is both challenging and interesting work,” said Dalal, who started studying solar technology in 1972 when he decided he didn’t want to develop smart bomb technology for a defense contractor. “I find it is tremendously interesting, even after 34 years. And it helps humanity instead of killing it, which allows me to sleep at night.”

Source: Iowa State University

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