Technology Review
PUBLISHED BY MIT

Thursday, March 27, 2008

More-Powerful Solar Cells

A new kind of solar cell is 27 percent more efficient without being more expensive to make.

By Kevin Bullis

An MIT researcher has found a way to significantly improve the efficiently of an important type of silicon solar cells while keeping costs about the same. The technology is being commercialized by a startup in Lexington, MA, called 1366 Technologies, which today announced its first round of funding. Venture capitalists invested $12.8 million in the company.

1366 Technologies claims that it improves the efficiency--a measure of the electricity generated from a given amount of light--of multicrystalline silicon solar cells by 27 percent compared with conventional ones. The company's efficiency and cost claims are based on results from small solar cells (about two centimeters across) made in the lab of Emanuel Sachs, a professor of mechanical engineering at MIT, who is one of the company's founders. 1366 Technologies is building a pilot-scale manufacturing plant that will make full-sized solar cells (about 15 centimeters across). Within a year, the company will decide whether its pilot-plant results justify building a factory for commercial production, Sachs says.

Commercial solar cells made from multicrystalline silicon are normally far less efficient than more expensive ones made from single-crystal silicon, but they're cheaper. The 27 percent improvement will bring multicrystalline cells to efficiencies about the same as single-crystal cells--around 19.5 percent--at the lower costs. So, if the technology successfully scales up, Sachs says, it could significantly bring down the cost of solar electricity. Sachs says that today, solar cells cost about $2.10 per watt generated. When manufactured at a commercial scale, the first cells incorporating his new technology will cost $1.65 per watt. Planned improvements will bring down this cost to about $1.30 a watt, he says. To compete with coal, the cost will need to come down to about $1 a watt, something that Sachs predicts can be achieved by 2012 with further improvements in antireflection coatings and other anticipated advances.

The company's first prototype solar cells include three key innovations to improve efficiency. The first is a method for adding texture to the surface of the cells that allows the silicon to absorb more light, a trick that's been used before with single-crystalline devices but has been difficult to implement with multicrystalline silicon. The rough surface causes light to bend as it enters the cell so that when it encounters the back of the cell, it doesn't reflect right back out; rather, it bounces off at a low angle and remains inside the slab of silicon. The longer the light remains within the silicon, the greater the chance that it will be absorbed and converted into electricity.

The second innovation involves the silver wires that harvest electrical current generated by the silicon. Sachs has developed a method for making these wires as small as one-fifth the width of the wires that are typically used, while improving their conductivity. The thinner wires use less silver, which cuts down costs. Also, because the wires are thinner, they can be spaced closer

together and still block less light than ordinary wires can. The closer spacing makes the wires more efficient at collecting electrical current generated in the silicon.

The final improvement has to do with a set of wide, flat wires used to collect current from the thin silver wires. These bars typically block light entering the cell, reducing efficiency. But Sachs has etched their surfaces so that they act as faceted mirrors. This achieves an effect similar to the texturing of the silicon surface. While the improvements add costs in some ways, the increases are offset by savings elsewhere, such as from using less silver, Sachs says.

While 1366 Technologies plans to manufacture its own cells, Sachs says that it is also open to licensing the technology to other solar-cell makers. Ultimately, Sachs hopes that his technology will speed the adoption of solar power to meet global energy requirements. "We need an exponential growth curve now," he says. "Not 15 years from now--that's too late."