V-shaped solar cells could lead to better efficiency

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"In solar cells," Peter Peumans tells *PhysOrg.com*, "the goal is always higher efficiencies. Higher efficiencies usually mean lower cost."

As solar cells continue to be more important as renewable energy sources, affordable techniques for producing solar cells will be in demand. Peumans, a scientist at Stanford University, and his colleagues Seung-Bum Rim, Shanbin Zhao, Shawn R. Scully and Michael D. McGehee describe one such technique to increase solar cell efficiency: v-shaped cells. The results of their findings are reported in *Applied Physics Letters*: "An effective light trapping configuration for thin-film solar cells."

Peumans explains that he and his peers used organic solar cells to develop their technique. Organic solar have an active layer made out of molecules, such as pigments or polymers. They are low-cost and flexible. However, as Peumans points out, "organic solar cells typically have low efficiencies."

A traditionally designed organic solar cell consists of a film layer of the light absorbing material spread on top of some sort of substrate. The Stanford team found that if they took a traditionally designed solar cell and then bent it to form a v-shape, it was possible to significantly increase the efficiency of the cell. "It's about light management," Peumans says. "This is a pretty simple solution."

Peumans goes on to explain that most organic solar cells are made on planar substrates. “When the light hits it, there is only one bounce – only once chance for the light to be absorbed.” The v-shape, he continues, creates an environment in which the light can bounce around. “Every time the light bounces, it has a chance to be absorbed into the cell.”

Organic solar cells are defined mainly by a “thin film of organic material sandwiched between two electrodes,” Peumans explains. This is what makes them low cost and flexible. For the most part, due to their low efficiency, they are not realistically considered for energy generation on a large scale. However, the technique developed at Stanford has the potential to change that. “We were able to increase the efficiency by 52 percent,” he says. “The same cell generates more electrical power.”

Organic solar cells are not the only technology that could make use of this efficiency-boosting technique. “While this works particularly well on organics,” Peumans says, “it can be applied to other thin film solar cell technologies as well.” He explains that they evaluated the potential for increased efficiencies in thin film silicon solar cells. “For many solar cell technologies, it would make sense to adopt this approach.”

Peumans says that there is already a company working on this technique, “trying to improve the concept and trying to get even higher efficiency out of it.” He also points out that he and his colleagues performed a cost analysis on their method. “Companies would have to figure it out on a case by case basis,” he concedes, “but the numbers we looked at indicated that you could produce solar modules at a lower cost per installed Watt.”

While organic cells would likely need further development to become practical for large-scale electrical power generation uses in grids, the idea of a v-shaped solar cell could be incorporated into existing then film solar cells.

“This is potentially a very simple application technique,” Peumans says. “It could be a way to increase the efficiency of different types of thin film solar cells.”