Self-building solar cells

By Dan Jones | 01/12/10 - 09:19

Self-Building Solar Cells

The next generation of solar cells has been inspired by the physical principles crucial to dressing your salad.

The BBC reports that researchers at the National Academy of Sciences have come up with a cheap and simple method of developing self-building electronic devices, using the principal that oil and water-based fluids do not mix. The scientists have managed to form devices from components that align along the boundary between the two, and is particularly useful for assembling small components.

The technology could revolutionise the solar cell industry in that it allows for the large-scale assembly of high-quality electronic components.

The more traditional way of assembling electronic components relied on so-called "sedimentation" which, put crudely, exploited the effects of gravitational pull using "blank" devices that are etched with depressions to match precisely-shaped components, as explained by the BBC.

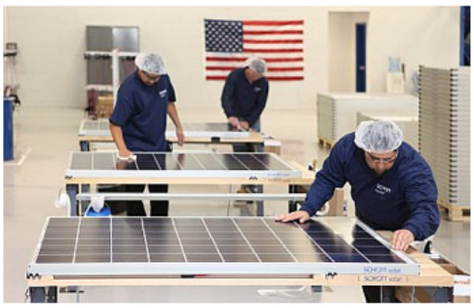
Like sand on a riverbed

When dumped into a liquid the components should settle down into the blank device just like sand on a riverbed.

"That's what we tried for at least two years and we were never able to assemble these components with high yield - gravity wasn't working," explained Heiko Jacobs of the University of Minnesota, who led the research.

In an interview with BBC news he added, "Then we thought if we could concentrate them into a two-dimensional sheet and then have some kind of conveyor belt-like system we could assemble them with high yields and high speed."

By building these two-dimensional sheets at the border between oil and water they were able to do very much the same thing but far more efficiently.



As before, they first built a blank device with depressions lined with low-temperature solder, designed specifically for individual solar elements. They then prepared the elements - each a silicon and gold stack a few tens of millionths of a metre across - and put different coatings on each side.

A "floating sheet" of element

A hydrophobic molecule was added to the silicon side so to evade contact with water. On the gold side they placed a hydrofilic molecule to do the opposite and seek out the water.

The balance in density of the oil- and water-based parts needs to be just right in order for a "sheet" of elements to "float" between the two. And, thanks to their individual coatings, the elements will face in the correct direction.

The conveyor belt process is to simply dunk the device blank through the boundary and draw it back slowly; the sheet of elements rides up along behind it, each one popping neatly into place as the solder attracts its gold contact, as explained by the BBC's science and technology reporter Jason Palmer.

Far more efficient solar cells

In just three minutes the researchers were able to make a working device made up of 64,000 elements.
The technology means that highly efficient solar cells can be built quickly and cheaply on various materials, "self-assembly is probably the best method for integrating high-performance materials onto unconventional substrates," explains Babak Parviz a nano-engineering professor at the University of Washington in Seattle.

If the method is proven to work on an even smaller scale it will allow scientists to use single-crystal silicon in the construction of solar cells, making them far more efficient than those built with other types of silicon.

Image: BBC.co.uk

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