Cheap and efficient solar cell made possible by linked nanoparticles

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Researchers of the Chemical Engineering department and the Kavli institute of Delft University of Technology in the Netherlands have demonstrated that electrons can move freely in layers of linked semiconductor nanoparticles under the influence of light. This new knowledge will be very useful for the development of cheap and efficient quantum dot solar cells. The researchers published their findings on Sunday 25 September on the website of the scientific journal *Nature Nanotechnology*.

The current crystalline silicon solar panels are expensive to produce. Cheaper solar cells are available, but these are inefficient. For example, an organic solar cell has a maximum efficiency of 8%. One way of increasing the efficiency of cheap solar cells is the use of semiconductor nanoparticles, quantum dots. In theory, the efficiency of these cells can be increased to 44%. This is in part due to the avalanche effect, demonstrated by researchers from TU Delft and the FOM Foundation in 2008. In the current solar cells, an absorbed light particle can only excite one electron (creating an electron-hole pair), while in a quantum dot solar cell a light particle can excite several electrons. The more electrons that are excited, the greater the efficiency of the solar cell.

Up to now, the creation of electron-hole pairs under the influence of light was only demonstrated within the limits of a quantum dot. To be usable in solar cells, it is essential that electrons and holes are able to move. This is what creates an electrical current that can be collected at an electrode. Researchers from the same research group have now

demonstrated that the electron-hole pairs can also move as free charges between the nanoparticles. To this end they linked nanoparticles together, using very small molecules, so that they were very densely clustered while still remaining separate from each other. The nanoparticles are so close together that every single light particle that is absorbed by the solar cell actually causes electrons to move.

Provided by Delft University of Technology