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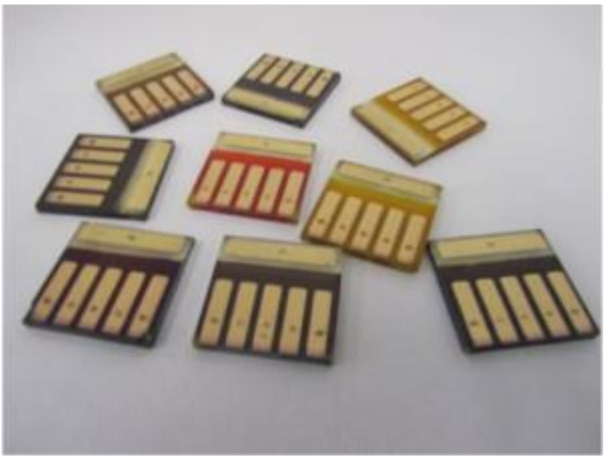
Graphene-Perovskite Thin-Film Solar Cell Achieves 15.6% Record



Researchers from the Universitat Jaume I (UJI), in Castelló, Spain, and the University of Oxford, UK, have designed a highly efficient solar cell based on perovskite as light absorber and a combination of titanium oxide and graphene as charge collector. The device, fabricated at temperatures below 150 degrees Celsius, achieved a record efficiency of 15.6% for graphene solar cells.

Applied physics professor Juan Bisquert concurs, perovskite is happening in solar. (Two upcoming conferences — Hybrid and Organic Photovoltaics HOPV 2014 and Solution-Processed Semiconductor Solar Cells SPSSC 2014 — will feature special sessions on perovskite.) "The material has extraordinary photovoltaic properties, and it has jumped very rapidly since discovery to competitive conversion efficiencies." Under his leadership, the Group of Photovoltaic and Optoelectronic Devices (DFO) at UJI, together with Henry Snaith's group at Oxford, have built a photovoltaic (PV) device based on graphene (solar's other darling material) and perovskite. "Optimising contacts to the perovskite absorber is a major route of development for this technology," he says, adding that a combination of graphene and TiO2 has shown outstanding properties.

Bisquert believes that what makes this device highly efficient at converting sunlight is that graphene matches perovskite's energy level for extracting electrons remarkably well, which improves the photocurrent the cell delivers. The professor illustrates why the record-achieving device could be a game-changer for solar energy: "The processing temperature is a key factor for the final cost of the cell," he says. Thanks to this new combination of materials, the "hottest" processing step occurs below 150 degrees Celsius. "Combined with availability of materials, this device has the potential for a real cheap high efficiency technology."

However, this new type of device based on a combination of perovskite and graphene is not quite ready for commercialisation. For one thing, Bisquert says, "The stability of the material has to be improved, but this will depend also on encapsulation issues." Once "the scientific community” can sufficiently innovate the raw components of the cell, “20% efficiency seems very possible to reach.”

Due to its record-breaking sunlight conversion efficiency in combination with the low processing temperatures, which will lower manufacturing costs, this thin-film photovoltaic device “should aim at the large scale energy supply,” Bisquert says, in regard to potential applications. “But it also has desirable properties for fancy or portable applications.”

The next step for Bisquert and his team? “We want to understand how this new and miraculous material works inside,” he says. “This will open the door for further improvements of materials. Perovskite has a rich structure and allows lots of combinations of components.”

The results of this study are detailed int he article “Low-Temperature Processed Electron Collection Layers of Graphene/TiO2 Nanocomposites in Thin Film Perovskite Solar Cells,” published in *Nano Letters*.

Written by Sandra Henderson, Research Editor *Solar Novus Today*

- See more at: http://www.solarnovus.com/graphene-perovskite-thin-film-solar-cell-achieves-15-6-record_N7403.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+SolarNovus+%28Solar+Novus+Today+-+Delivering+today%27s+solar+technology+news%2C+today%29#sthash.afB2RBdu.dpuf