ORGANIC PHOTOVOLTAICS

Ready-to-use sheets

Adv. Mater. https://doi.org/10.1002/adma.201902965 (2019)

The development of new non-fullerene acceptors has recently enabled power conversion efficiencies over 16% in organic solar cells. Yet these results are based on a device architecture that contains layers prone to degradation, most notably a commonly employed polymer-based hole transport layer. Low-dimensional layered transition-metal disulfides offer a more stable alternative but their use has been held back so far by complex high-temperature post-processing treatments. Now, Thomas Anthopoulos and colleagues from King Abdullah University of Science and Technology overcome this by demonstrating a two-dimensional tungsten disulphide hole transport layer based on solution processing without the need for any further treatment. With this layer they are able to fabricate 17%-efficient organic solar cells.

The researchers obtain two-dimensional nanosheets of tungsten disulphide via liquid exfoliation of the layered bulk crystals. The suspension containing the nanosheets is then cast onto the electrode at room temperature without any post-treatment. Just a few monolayers of tungsten disulphide are sufficient to fully cover the electrode surface and tune its work function, enabling a better hole extraction and lower charge recombination. The tungsten disulphide transport layer shows similar, if not higher, solar cell efficiency across a number of different organic active blends as compared to a control device with a polymer hole transport layer. The study thus confirms the potential of low-dimensional transition metal disulfides as hole transport layers for low-cost organic photovoltaics.

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Published online: 14 November 2019
https://doi.org/10.1038/s41560-019-0505-0