Efficient organic solar cells with very low driving force

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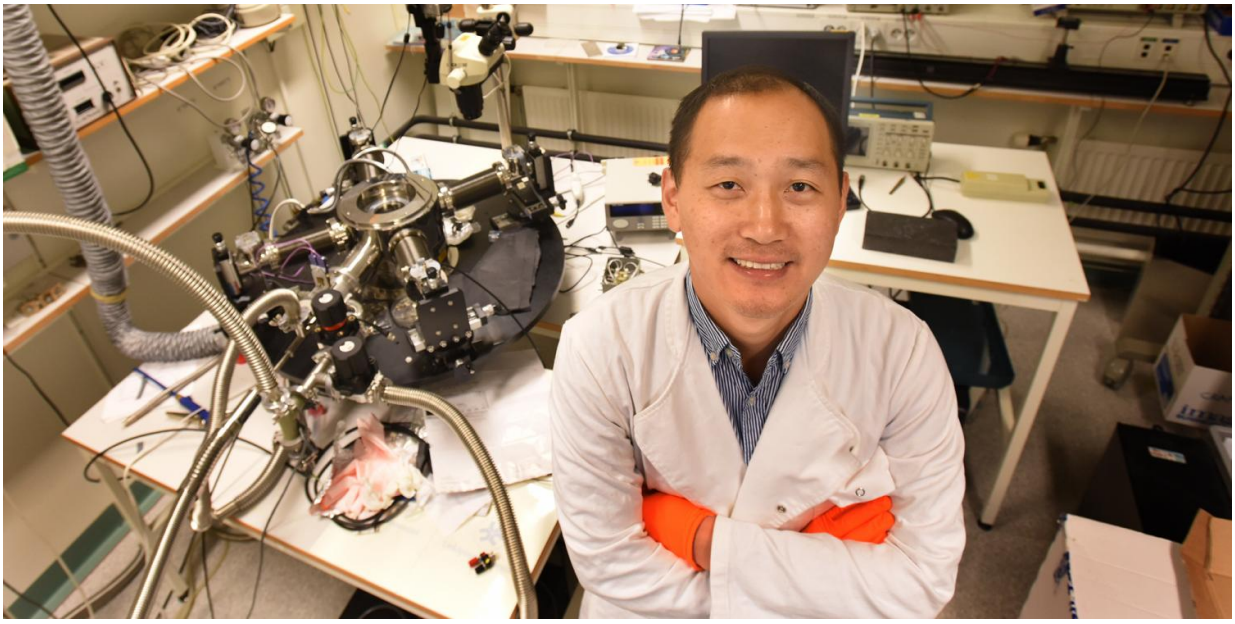

Research fellow Feng Gao, Linköping University. Credit: Photo Göran Billeson

Researchers at Linköping University, together with Chinese and American colleagues, have developed organic solar cells with a significantly lower driving force and faster charge separation than previous cells. The results have been published in *Nature Energy*.

It was believed that efficient operation of organic solar cells requires a large driving force, which limits the efficiency of organic solar cells.

Now, a large group of researchers led by Feng Gao, lecturer at IFM at LiU, He Yan at the Hong Kong University of Science and Technology, and Kenan Gundogdu at the North Carolina State University have developed efficient organic solar cells with very low driving force.

This implies that the intrinsic limitations of organic solar cells are no greater than those of other photovoltaic technologies, bringing them a step closer to commercialisation.

When photons emitted by the sun are absorbed by organic semiconductors, strongly bound excitons (rather than free carriers) are generated. The driving force is, to put it simply, a measure of the energy that is used to split the excitons into free carriers. The driving force results in the loss of the photovoltage, a key parameter for the solar cell. The lower the driving force, the higher the photovoltage.

Traditionally, efficient organic solar cells are usually composed of semiconducting polymers and carbon balls known as 'fullerene'. In that case, a large driving force over 0.3 eV is usually needed for efficient charge generation. In the present work, the researchers have replaced fullerene with a semiconducting small molecule, and found that that a low driving force is needed for efficient operation of the devices. In addition, organic solar cells based on polymer: small molecule combinations are more stable, as shown in another work also led by Feng Gao and his collaborators in Beijing, published in *Advanced Materials*.

"We have developed a system with a huge potential to increase the power conversion efficiency in organic solar cells," says Feng Gao.

Feng Gao, together with his LiU colleagues, including Professor Olle Inganäs, Professor Fengling Zhang, postdoc Jonas Bergqvist and PhD student Deping Qian, describes in the article solar cells with an energy efficiency of 9.5%, which means that 9.5% of the energy in the sunlight

is converted to electricity.

The results have been published in *Nature Energy*.

More information: Jing Liu et al, Fast charge separation in a non-fullerene organic solar cell with a small driving force, *Nature Energy* (2016). DOI: 10.1038/nenergy.2016.89

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