OPTIMISATION OF ORGANIC BULK HETEROJUNCTION SOLAR CELLS

LEAD ORGANISATION
Imperial College London
Blackett Laboratory
Prince Consort Road
London
SW7 2BW
Contact: Prof Jenny Nelson
E-mail:
Jenny.Nelson@imperial.ac.uk

PARTNERS
Konarka Technologies

COST AND DURATION
The Carbon Trust contribution towards this project is £54,400. The project started in March 2008 and is due for completion in February 2010.

PROJECT REFERENCE NUMBER
064-179

OBJECTIVES

The aim of this project is to develop processes to improve the power conversion efficiency of polymer-based solar cells by optimising the film morphology and reducing other losses. The potential increases in efficiency, to over 7% from 5%, can accelerate implementation of organic photovoltaic (PV) technology.

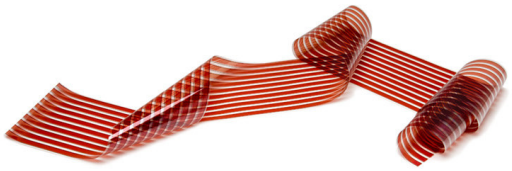
SUMMARY

Organic and polymer-based photovoltaic cells have potential applications as flexible, low-cost and solution-processible power sources. These characteristics mean that, compared with conventional rigid silicon technologies, they are potentially viable in many more applications, even though their power conversion efficiencies are lower.

At present, the highest power conversion efficiency reported to date for so-called 'bulk heterojunction structures' is about 5%. This is considered by many to be the minimum acceptable efficiency for commercialisation of new, thin-film PV technologies. Widespread take-up of the technology requires a higher power conversion efficiency. To achieve this, improved materials and fabrication processes are needed.

This project will address materials issues to increase the power conversion efficiency of organic, semiconductor-based solar cells from about 5% to values in the range 7% to 10%. Such efficiencies are achievable in theory and this project will investigate how they can be achieved in practice.

To achieve these higher efficiencies, the project will develop and apply techniques to control the morphology of the materials in the active layer.



A flexible, organic bulk heterojunction solar cell

In the active layer, a blend of a polymer and a small molecule such as a C60 derivative, absorbs light to generate separate charges that produce an electric current. The efficiency of this light-to-power conversion depends critically upon the phase morphology of the two components in the blend.

The work will focus on new polymer materials which have the potential for higher efficiency, but whose performance in devices has so far been limited through poor control of the physical morphology.

The project brings together the expertise available at Imperial College London in characterisation of organic photovoltaic materials and that of Konarka Technologies in device evaluation and manufacture.

Working with novel materials supplied by Konarka Technologies, researchers at Imperial will apply material and device characterisation techniques to identify the sources of loss in state-of-the-art devices. New physical and chemical processes will be developed to control the phase morphology. This will potentially enable sources of loss to be eliminated, thus enabling the materials' full potential for power generation to be exploited.

Konarka Technologies will demonstrate the optimisation processes in pilot production lines.

CARBON TRUST