Organometallic-functionalized interfaces for solar cells

Current issue

Traditional solar cells are made from silicon. They possess good efficiency and stability but are relatively expensive to make and can only be manufactured in stiff panels.

Perovskite solar cells offer an intriguing alternative; they can be printed from inks, making them low cost, efficient, lightweight and flexible. However, they have trailed behind silicon solar cells in efficiency and, importantly, stability, breaking down under normal environmental conditions.

Proposed solution

This relates to materials for interface layers for metal halide perovskite solar cells and a photovoltaic cell comprising an interface layer.

Metal halide perovskites are cheap, and simple to manufacture via a range of different fabrication process and techniques. Metal halide perovskites are commonly used as light absorbing layers in thin film solar cells, leading to the provision of low-cost, lightweight solar cells. Such metal halide perovskite solar cells (metal halide PVSCs) have emerged as a ground-breaking photovoltaic technology, with power conversion efficiencies (PCE) of 25.5% being realised for single-junction PVSCs. PVSCs have now surpassed the efficiency of commercialised thin-film solar cells (such as cadmium telluride, CdTe, or copper indium gallium selenide, CIGS) and approach the efficiency of state-of-the-art crystalline-silicon solar cells.

The invention

Organometallic chemistry-inspired interface functionalisation of the inverted perovskite solar cell. Inverted perovskite solar cells are known but have never featured such an organometallic interface. The novel organometallic compound combines the merits of organic and inorganic materials, and not only provides molecular flexibility and chemical Pb-O binding to reduce surface trap states, but also accelerates interfacial electron transfer via ferrocene and thiophene units.

Application

Stable, efficient and low-cost organometallic-inspired perovskite cells could ultimately allow solar energy to be used in more applications – from powering the developing world to charging a new generation of wearable devices.

Benefits

- Metal halide perovskites are cheap, and simple to manufacture leading to low-cost, lightweight solar cells.
- PVSCs have now surpassed the efficiency of commercialised thin-film solar cells (such as cadmium telluride, CdTe, or copper indium gallium selenide, CIGS)

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Intellectual property information

Perovskite solar cell with interface layer is protected by UK patent application: GB2205772.3 and PCT application: EP2023/060281.

Link to published paper(s)

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