New Organic Photovoltaic Materials Achieving Record-High Efficiency

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Background

Environmentally friendly organic solar cells with record-high performance have been developed. A series of organic/polymer materials for highly efficient organic solar cells has been synthesized. It is vital that the solar cells do not contain toxic substances and that no hazardous solvents are used during the production process. Whilst organic solar cells do not contain toxic components, high performance can only be achieved using hazardous processing solvents, hindering the development of these cells.

Single-junction organic solar cells with an officially certified record-high efficiency of 11.5% have been developed. This achievement was noted as a major technological breakthrough in the renowned NREL chart of "Best Research-Cell Efficiencies". Certain polymeric donor materials have also been found to show temperature-dependent aggregation behavior. This phenomenon has been used to fabricate high performance organic solar cells. In addition, we have discovered a system of non-fullerene organic solar cells with fast charge separation that requires only a small driving force, achieving an open-circuit voltage of 1.11 V and a power conversion efficiency of 9.5%.

Technology Overview

We discovered that a near-optimal morphology can be achieved by combining low-cost hydrocarbon solvents, which can be readily obtained from petroleum, and polymers with specially tailored side chains. The performance of the resulting solar cell surpasses even that of conventional technologies that use hazardous solvents. The discovery provides important guidance for research on efficient solar cells created using environmentally friendly processes.

Benefits

- Low cost.
- Eco-friendly.
- High conversion efficiency.
- High transparency.

Figures