Nonconfidential Summary Disclosure

UM 8780: Indolizine-Based Donors as Organic Sensitizes for Components for Dye Sensitized Solar Cells (DSCs)

THE TECHNOLOGY

Researchers at the University of Mississippi have, for the first time, demonstrated the viability of organic indolizine as an effective organic donor material component for organic sensitizers. The use of these indolizine donors allows for a broad range of usable sunlight wavelengths in DSCs utilizing an organic dye and increases electron density providing higher power conversion efficiencies (PCEs).

These sensitizer components are key to the development of practical DSC devices and consist of three primary components: a donor, a π-bridge, and an acceptor (D-π-A).

The most affordable and safest class of donor structures are based on organic materials. Indolizine-based organic dyes used in D-π-A configurations can be synthesized in fewer steps than record dyes (3-5 compared to 10-15) while maintaining the same sunlight conversion capacity; resulting in a lower manufacturing cost.

Additionally, indolizine donor classes are uniquely tunable to match the requirements of the other bridge and acceptor components (other donor classes do not allow coarse tuning of molecular energy levels) allowing for competitive performing DSC products at a fraction of the cost. Further, indolizine tunability allows for access to additional spectral regions and use of lower energy sunlight than traditional DSC donor materials.

Indolizine dyes are also stable under ambient conditions which circumvents the need for costly oxygen free production.

Organic based sensitizers have continued to show improvement on PCEs of > 14% and have surpassed cost / benefit valuation equality with metal-based sensitizers.

Production costs are tied to cost-effective solution casting technologies, such as ink jet printing.

COMPETITIVE ADVANTAGE

DSC technologies are a key component to flexible solar cell technologies in demand by the US Military, indoor light harvesting low energy electronics, and powering building integrated technologies.

This technology offers improved performance-to-cost ratio and can utilize a larger spectral region, including low energy sunlight applications, compared to other DSC technologies.

DEVELOPMENT POTENTIAL

Several models of this technology have been developed with simple π-bridges and acceptors. We are seeking a commercial partner for further development of this technology.

PATENT STATUS

U.S. 10,562,913

PRINCIPAL INVESTIGATOR(S)

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KEYWORDS

Solar Cell, Dye, Sensitizer, Energy, Organic Electronics, Power Conversion, Indolizine, Donator, Dye-Sensitive Solar Cell, Planar, Silicon, PCE, DSC

PUBLICATIONS

Huckaba, A. J.; Yella, A.; McNamara, L. E.; Steen, A. E.; Murphy, J. S.; Carpenter, C. A.; Puneky, G. D.; Hammer, N. I.; Nazeeruddin, M. K.; Grätzel, M.; Delcamp, J. H. “Molecular Design Principles of Near-Infrared Absorbing and Emitting Indolizine Dyes” 2016, DOI: 10.1002/chem.201603165

More publications availiable upon request.

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