Nanoparticles for Photovoltaic and LED Devices and Methods of Making the Same

This technology addresses the concerns of perovskite semiconductor instability and offers a nanoparticle surface treatment stable for months between -180C and 150C. The nanoparticles are bonded and exhibit electronic communication with over 10% efficiency.

What is the Problem?

Halide perovskites are used in optoelectronics, such as solar cells and light emitters. Research has shown that perovskite photovoltaic devices processed from solution inks can convert more than 22% of incident sunlight into electricity. This inexpensive processing method yields conversion rates at the top end of more costly silicon devices. However, the commercialization barrier for this technology is the instability of the semiconductor, posing the need for a new perovskite material that exhibits long term stability and durability.

What is the Solution?

The technology is a composition of nanoparticles of 0-100nm on a surface of compatible material. Inorganic perovskite nanocrystals can be separated from precursors more efficiently using methyl acetate as a solvent. Unlike the bulk, the nanocrystals are stable at room temperature. A new surface treatment has been developed leading to conductive films enabling high efficiency photovoltaics and efficient electroluminescence. The surface material enables the nanoparticles to maintain crystallinity at temperatures between -180C and 150C, showing stability for months in ambient air. The nanoparticle is composed of either a metal chalcogenide, a group III-V material, a metal oxide, or a perovskite. These nanoparticles are in electronic communication with each other and are bonded in some form to the surface material, and exhibit over 10% efficiency.

What is the Competitive Advantage?

Current solutions for perovskites disassociate into volatile compounds and are not stable in certain environmental conditions. This technology outlines synthesis routes for perovskite films and nanoparticles, with a variety of modifications available to optimize certain parameters for different applications. This technology addresses the problem of perovskite semiconductor instability. These novel synthesis methods create stable perovskites for optoelectronics, which has been a barrier for the adoption of this perovskites.

Technology ID

BDP 8653

Category

Cleantech/Solar

Selection of Available Technologies

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Patent Information:

US10273403B2

References

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