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Polymer Nanocomposites as Luminescent Down Shifting Layers

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Opinion

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EDITORIAL CORNER – A PERSONAL VIEW

Utilization of renewable energies is the need of the hour owing to the logarithmic amplification in fossil energy costs in tandem to trim down the carbon dioxide expulsion so as to thwart global warming. The energy from the sun is enormous and may be considered as the best alternate to satisfy the ever growing energy demand of future generations.

Dye-Sensitized Solar Cells (DSSCs) are being increasingly viewed as future generation photovoltaic materials that serve as an excellent alternate to conventional Silicon (Si) based systems owing to their low fabrication costs in conjunction with high photo-electron conversion efficiencies. However, highly performing conventional polypyridyl ruthenium (Ru) based DSSCs often suffer from the limited availability of precursor materials, thereby limiting their lucrative applications. Conversely, metal free organic dye molecules as sensitizers are on par with the efficiencies of conservative Ru-based complexes, but an universal setback is the relatively narrow absorption response that limits the optimal utilization of the solar spectrum and hence the device efficiencies.

In recent years, diverse strategies were proposed and a numerous methods were ventured to broaden the light-harvesting ability of DSSC devices, including the harmonization of absorption response by the use of multiple sensitizers with complementary electronic band structures, doping of the TiO_2 photo anode with a UV-excited luminescent compound, in addition to the application of tandem devices. Of all the stratagems adopted, the best suitable, more expedient and viable strategy may be the use of Luminescent Down-Shifting Layers (LDS) that extends the short wavelength limit of solar cell materials through the absorption of low energy UV-photons and their re-emission at longer wavelengths, where the photoactive materials of the voltaic cell typically show optimal spectral response leading to excellent device efficiencies. Polymer nanocomposite systems as LDS layers that take advantage of the synergistic interactions between the opto-electronically effective inorganic fillers and highly processable organic polymers. The undeniable significance of highly flexible and visible transparent polymer nanocomposites as LDS layers has led to the development of novel multifunctional polymer nanocomposite systems that may synergistically aid excellent structural support and out-door operational stabilities to DSSCs in addition to affecting appreciable photon cutting. To end up with, a significant breakthrough in the research and development of polymer nanocomposite as LDS layers that ensue exceptional DSSC efficiencies may be expected in the near future.