Photon Upconversion-Assisted Luminescence Solar Concentrators

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A luminescent solar concentrator-based photovoltaic system (LSC-PVs) is transparent because it collects solar light through the LSC, a transparent panel containing only fluorophores. Because of this reason, LSC-PVs is useful for building-integrated PV window. Here, we demonstrate an LSC-PVs, which is based on the combination of an upconversion (UC)- assisted dual band harvesting LSC and perovskite solar cells (PSCs) for the practical use of LSC-PV. We arrange a dual LSC panel consisting of a downshift (DS) LSC that convert violet light into blue light and upconversion LSC that convert red light into blue light. Although UC and DS dual panel absorbs visible light, ranging from 450 nm to 700nm, the dual LSCs coupled with a perovskite solar cell exhibit a high average-visible-transmittance (AVT) of 82% and attain a maximum efficiency of 7.53% under 1 sun (AM 1.5G) illumination. The dual panel LSC-PSC exhibits a constant efficiency even under oblique solar light illumination. A stable operation was measured on intermittent illumination with an efficiency retention of 80% up to 300 hours.