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Photon Upconverting Solid Films with Improved Efficiency for Endowing Perovskite Solar Cells with Near Infrared Sensitivity

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journal or publication title	ChemPhotoChem
year	2020-08-05
Publisher	Wiley VCH GmbH
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URL	http://id.nii.ac.jp/1394/00001568/

doi: info:doi/10.1002/cptc.202000143

Supporting Information

Photon Upconverting Solid Films with Improved Efficiency for Endowing Near-Infrared Sensitivity to Perovskite Solar Cells

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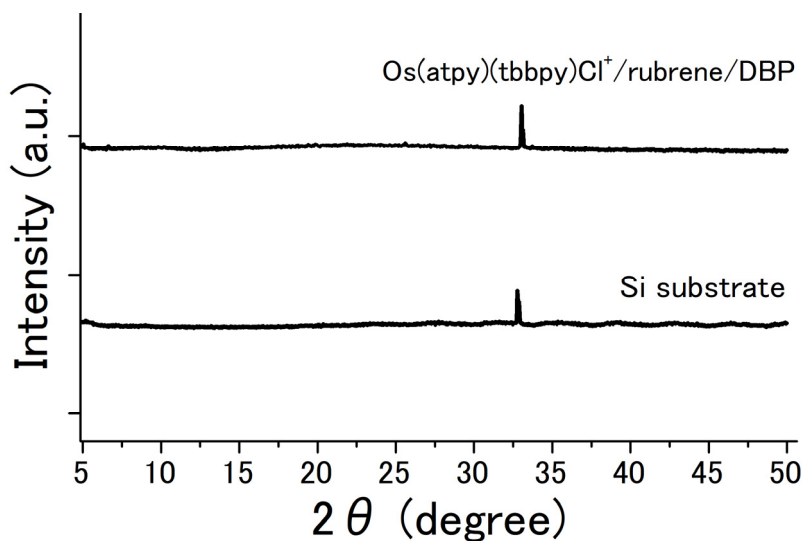


Figure S1. X-ray powder diffraction patterns of a Si substrate and Os(atpy)(tbbpy)Cl⁺/rubrene/DBP nanoparticles on the Si substrate.

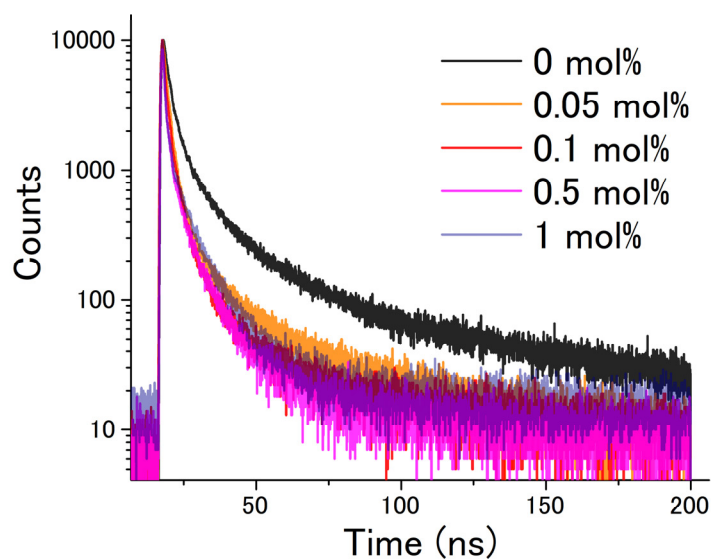


Figure S2. Fluorescence decays at 565 nm of the rubrene/DBP films with different DBP content ($\lambda_{\text{ex}} = 470$ nm). The increase of DBP ratio significantly shortened the fluorescence lifetime of acceptor rubrene due to the rubrene-to-DBP FRET.

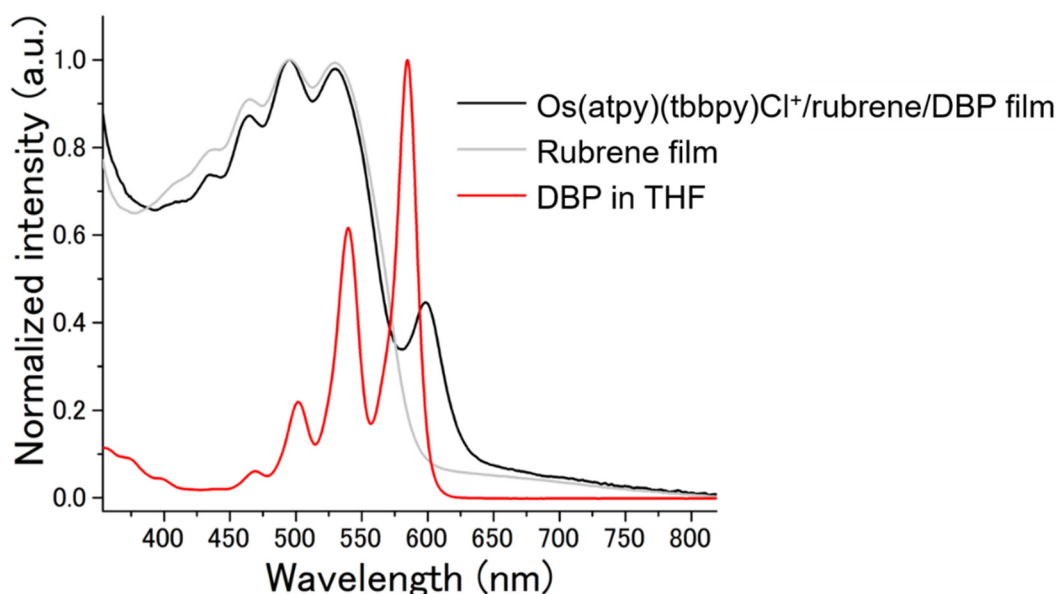


Figure S3. Absorption spectra of the rubrene and Os(atpy)(tbbpy)Cl⁺/rubrene/DBP films and of DBP in THF solution. 462 nm and 598 nm light are used to selectively excite acceptor rubrene and collector DBP, respectively, in the Os(atpy)(tbbpy)Cl⁺/rubrene/DBP film.

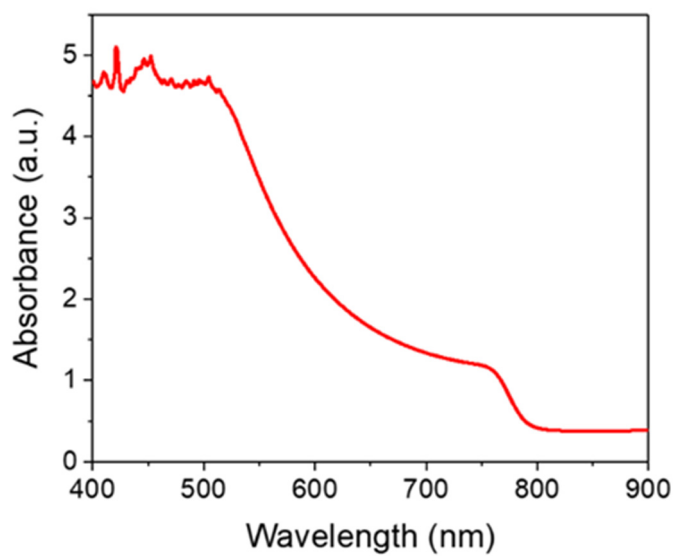


Figure S4. Absorption spectrum of the $\text{Cs}_{0.05}\text{FA}_{0.54}\text{MA}_{0.41}\text{Pb}(\text{I}_{0.98}\text{Br}_{0.02})_3$ film.

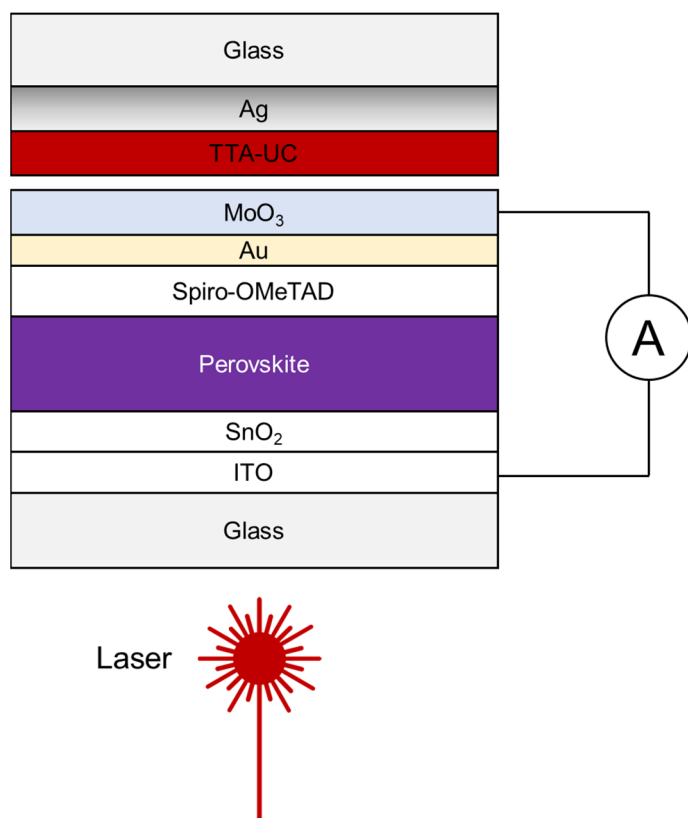


Figure S5. The device structure of the solar cell integrated with the TTA-UC film.

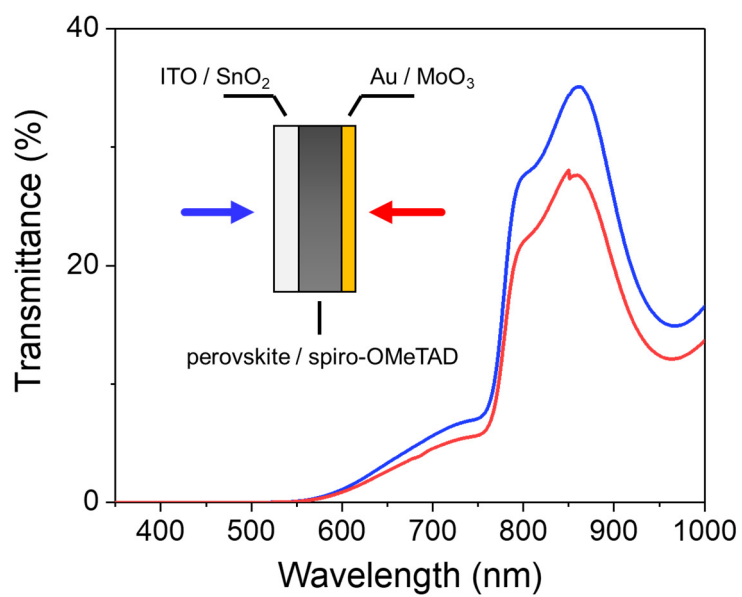


Figure S6. Transmission spectrum of the semi-transparent solar cell (ITO/SnO₂/Cs_{0.05}FA_{0.54}MA_{0.41}Pb(I_{0.98}Br_{0.02})₃/spiro-OMeTAD/Au (15 nm)/MoO₃). The blue line depicts the transmittance entering the ITO side, and the red line shows transmittance from the Au / MoO₃ side.