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

Author	Mika Kinoshita, Yoichi Sasaki, Shogo Amemori, Naoyuki Harada, Zhanhao Hu, Zonghao Liu, Luis K. Ono, Yabing Qi, Nobuhiro Yanai, Nobuo Kimizuka
journal or publication title	ChemPhotoChem
year	2020-08-05
Publisher	Wiley‐VCH GmbH
Rights	This is the accepted version of the following article: Kinoshita, M., Sasaki, Y., Amemori, S., Harada, N., Hu, Z., Liu, Z., Ono, L.K., Qi, Y., Yanai, N. and Kimizuka, N. (2020), Photon Upconverting Solid Films with Improved Efficiency for Endowing Perovskite Solar Cells with Near‐Infrared Sensitivity. ChemPhotoChem., which has been published in final form at https://doi.org/10.1002/cptc.202000143. This article may be used for non-commercialpurposes in accordance with the Wiley Self-Archiving Policy [https://authorservices.wiley.com/author-resources/Journal-Authors/licensing/self-archiving.html].
Author's flag	author
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

Mika Kinoshita, Yoichi Sasaki, Shogo Amemori, Naoyuki Harada, Zhanhao Hu, Zonghao Liu, Luis K. Ono, Yabing Qi, Nobuhiro Yanai* and Nobuo Kimizuka**

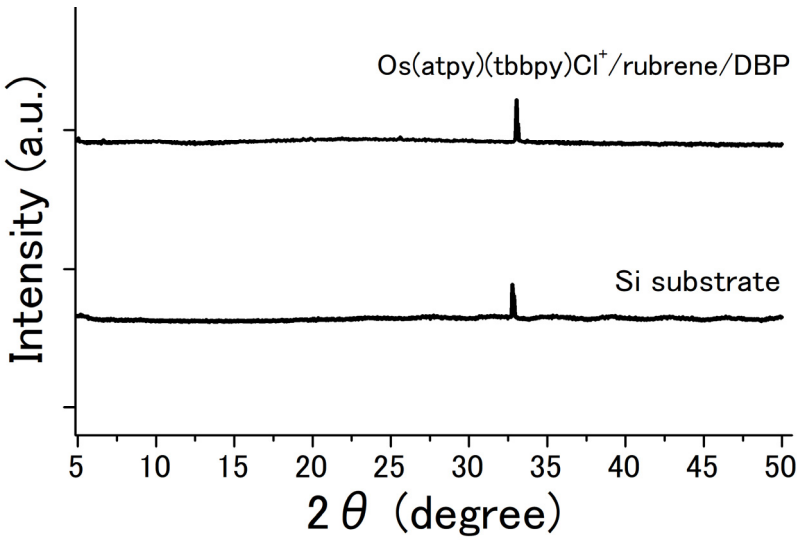

Figure S1. X-ray powder diffraction patterns of a Si substrate and Os(atpy)(tbbpy)Cl^+/rubrene/DBP nanoparticles on the Si substrate.

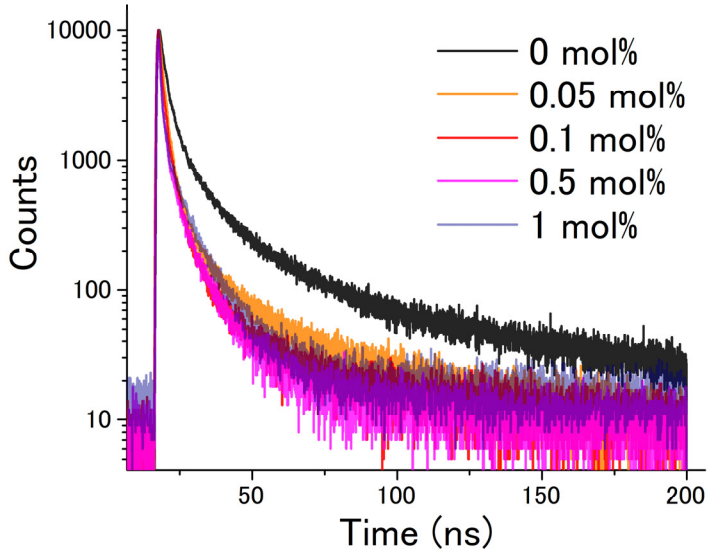

Figure S2. Fluorescence decays at 565 nm of the rubrene/DBP films with different DBP content (λ_{ex} = 470 nm). The increase of DBP ratio significantly shortened the fluorescence lifetime of acceptor rubrene due to the rubrene-to-DBP FRET.

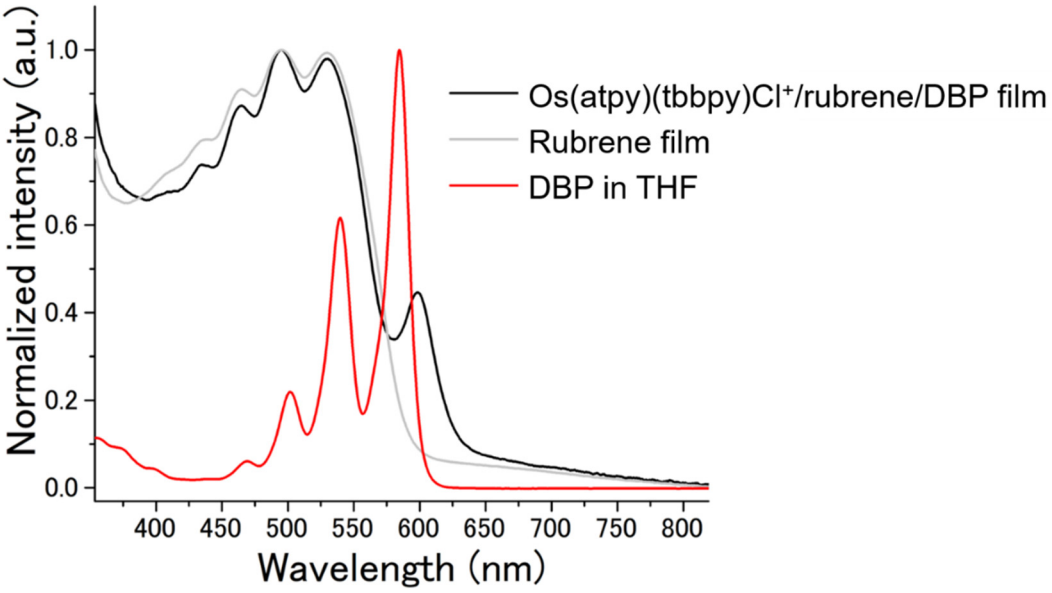

Figure S3. Absorption spectra of the rubrene and Os(atpy)(tbbpy)Cl^+/rubrene/DBP films and of DBP in THF solution. 462 nm and 598 nm light are used to selectively excite acceptor rubrene and collector DBP, respectively, in the Os(atpy)(tbbpy)Cl^+/rubrene/DBP film.

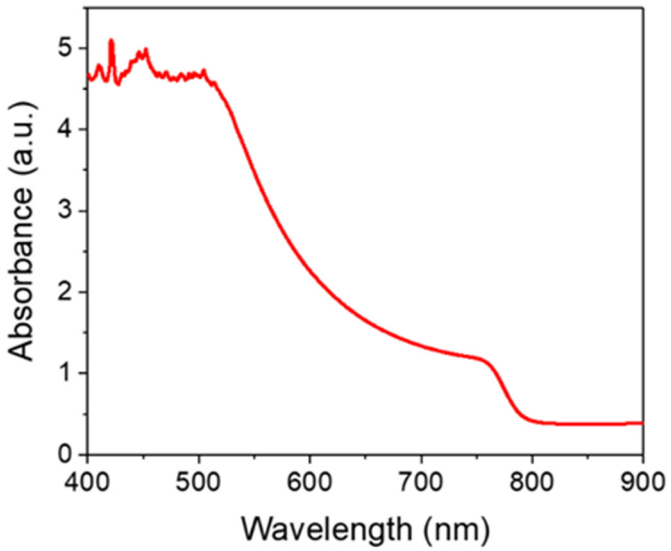

Figure S4. Absorption spectrum of the $Cs_{0.05}FA_{0.54}MA_{0.41}Pb(I_{0.98}Br_{0.02})_3$ film.

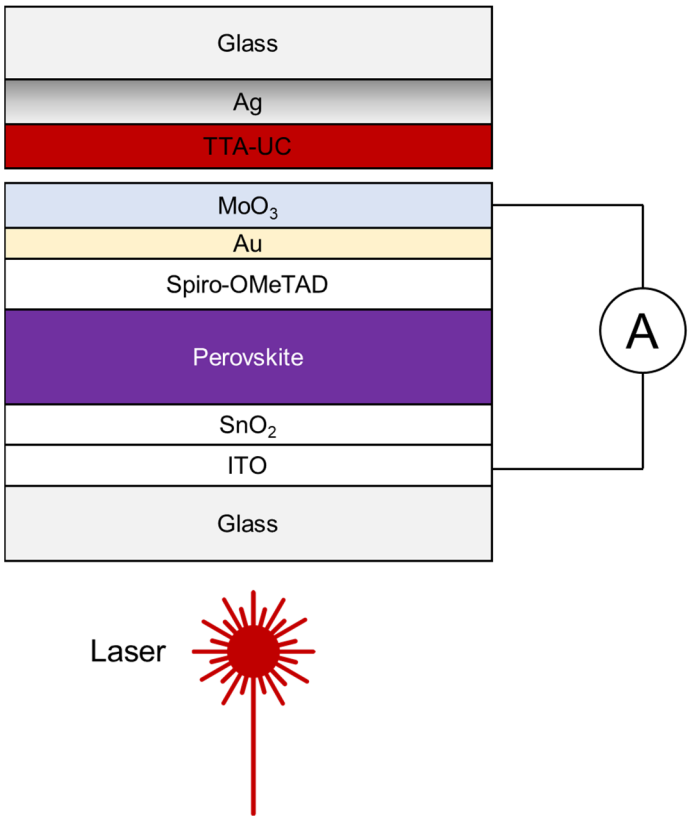

Figure S5. The device structure of the solar cell integrated with the TTA-UC film.

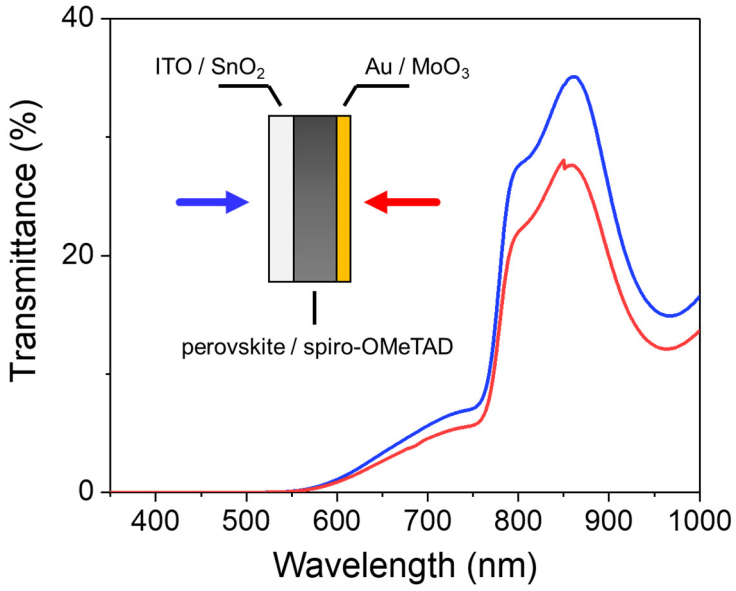

Figure S6. Transmission spectrum of the semi-transparent solar cell (ITO/SnO_2/ $Cs_{0.05}FA_{0.54}MA_{0.41}Pb(I_{0.98}Br_{0.02})_3$/spiro-OMeTAD/Au (15 nm)/MoO_3). The blue line depicts the transmittance entering the ITO side, and the red line shows transmittance from the Au / MoO_3 side.