

ADVANCED ENERGY MATERIALS

Supporting Information

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High-Performance Ta₂O₅ /Al-Doped Ag Electrode for
Resonant Light Harvesting in Efficient Organic Solar Cells

*Dewei Zhao, Cheng Zhang, Hyunsoo Kim, and L. Jay Guo**

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High-performance Ta₂O₅/Al-doped Ag Electrode for Resonant Light Harvesting in Efficient Organic Solar Cells

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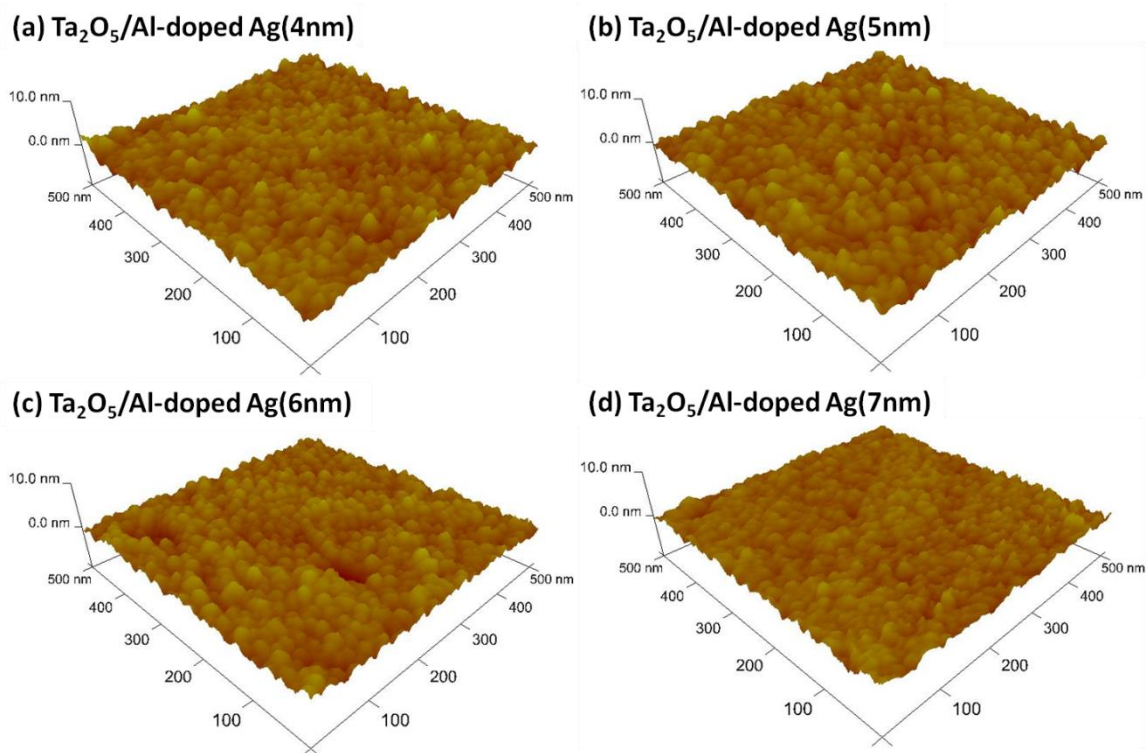


Figure S1. Tapping mode AFM image of (a) Ta₂O₅/Al-doped Ag (4 nm), (b) Ta₂O₅/Al-doped Ag (5 nm), (c) Ta₂O₅/Al-doped Ag (6 nm), and (d) Ta₂O₅/Al-doped Ag (7 nm), which exhibits the RMS roughness less than 1 nm.

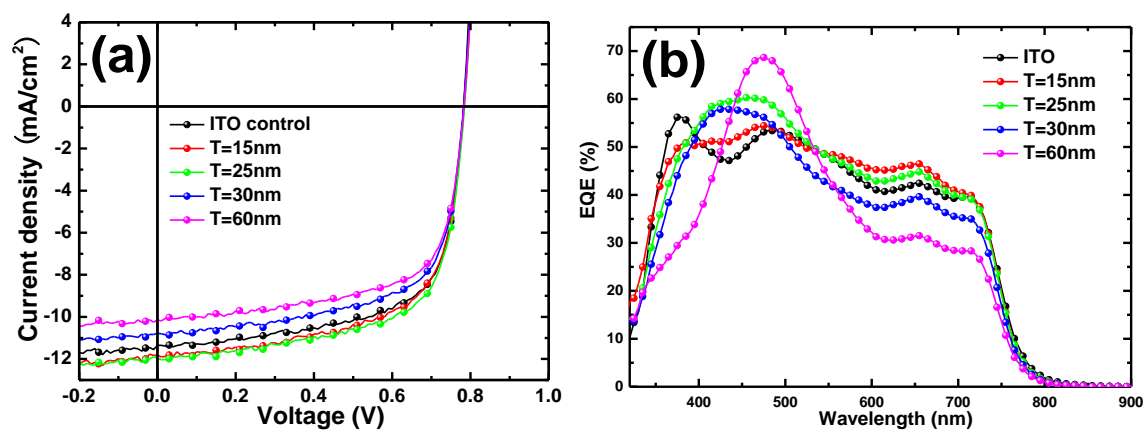


Figure S2. (a) J - V characteristics and (b) EQE spectra of ITO and Ta₂O₅ (x nm)/Al-doped Ag (7 nm) electrode based OPVs with thin PBDTTT-C-T:PC₇₀BM layer (50 nm).

The ITO-based device with 50 nm active layer has a PCE of 5.92% with a $J_{sc} = 11.35 \text{ mA cm}^{-2}$, $V_{oc} = 0.78 \text{ V}$, and FF = 66.9%. Device built on Ta₂O₅ (25 nm)/Al-doped Ag (7 nm) has a PCE of 6.23% with a $J_{sc} = 11.96 \text{ mA cm}^{-2}$, $V_{oc} = 0.78 \text{ V}$, and FF = 66.8%.

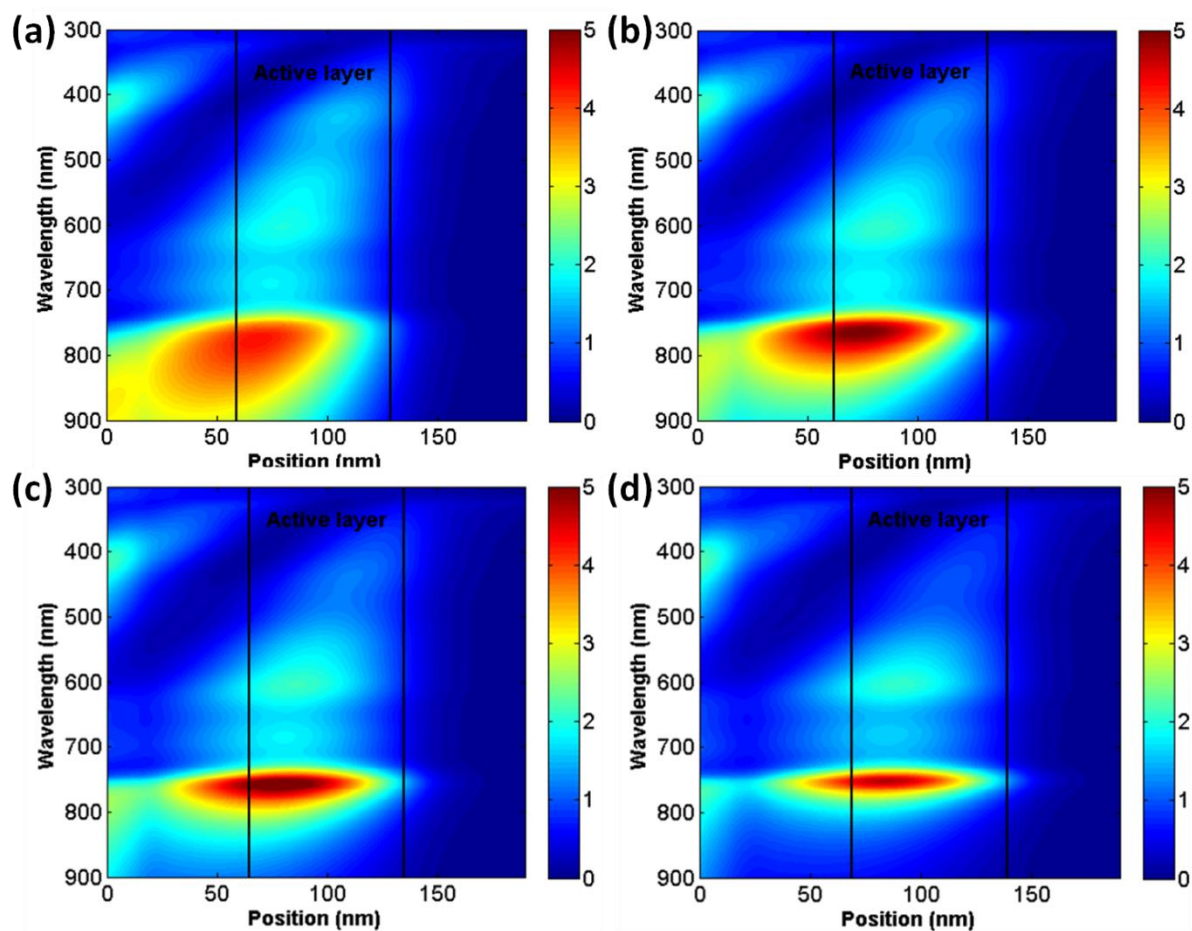


Figure S3. Simulation of the optical field intensity ($|E|^2$) distribution versus position and wavelength with varying Al-doped Ag electrode thicknesses at 4 nm (a), 7 nm (b), 10 nm (c) and 14 nm (d). The $\text{Ta}_2\text{O}_5/\text{ZnO}/\text{PBDTTT-C-T:PC}_{70}\text{BM}/\text{MoO}_3/\text{Ag}$ layer thicknesses are fixed at 15 nm/40 nm/70 nm/10 nm/100 nm respectively.

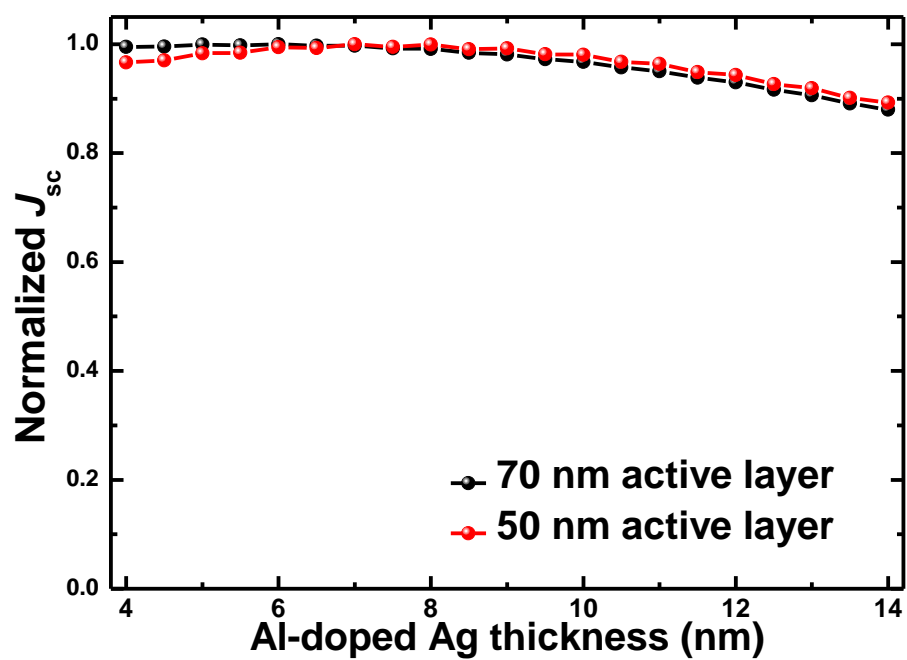


Figure S4. Simulated J_{sc} of the devices with varying thickness of Al-doped Ag layer from 3 nm to 14 nm and fixed other layer thickness.

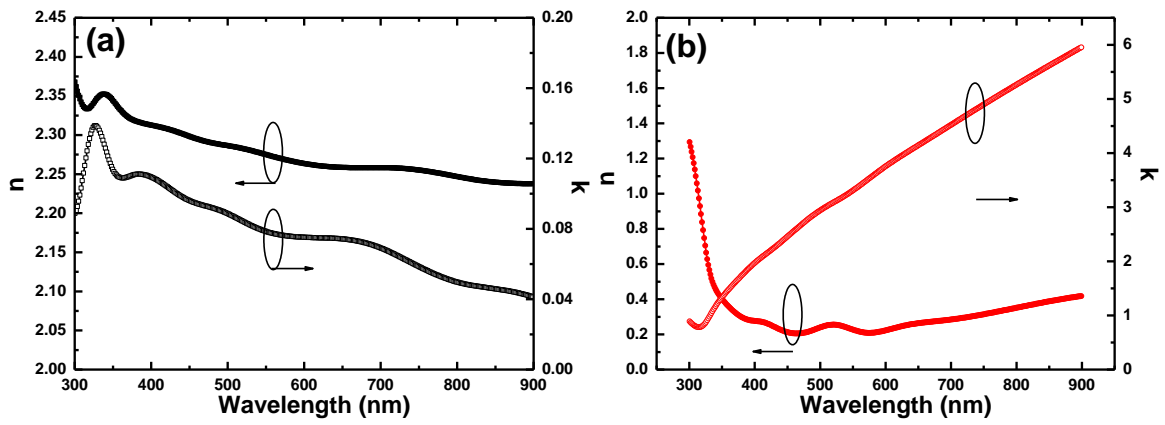


Figure S5. Refractive index (n and k values) of (a) Ta₂O₅ and (b) Al-doped Ag.