

Supporting Information

Enhancing Perovskite Solar Cell Efficiency and Stability through the Incorporation of BDAl_2 and DMPDAI_2

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Figures

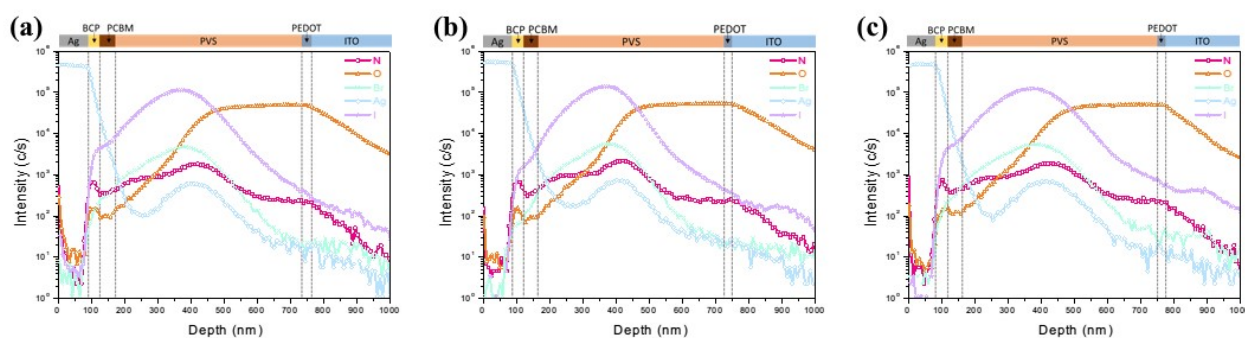


Figure S1 The SIMS depth profiles for (a) PSCs without 2D treatment, (b) PSCs treated with BDAl_2 , and (c) PSCs treated with DMPDAI_2 .

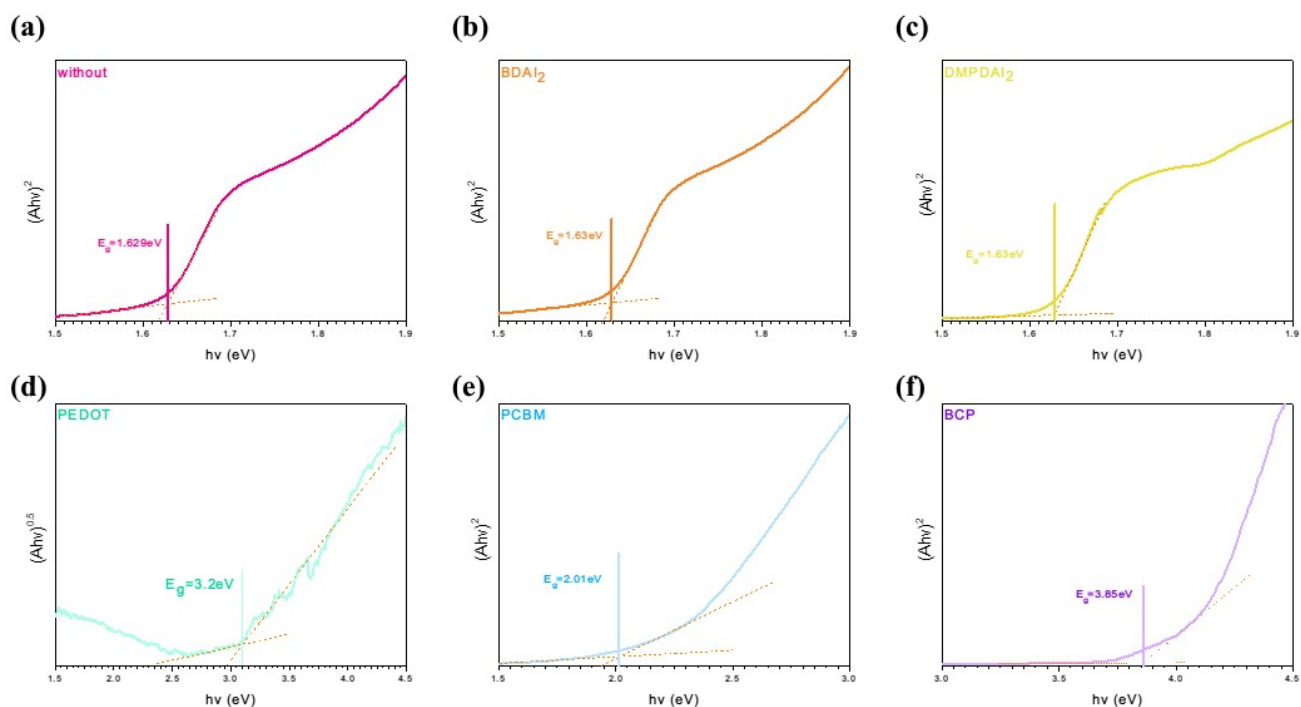


Figure S2 The Tauc plots extracted from UV-vis absorption spectra for various perovskite solar cell (PSC) films: (a) those without 2D treatment, (b) those treated with BDAI₂, (c) those treated with DMPDAI₂, as well as for (d) PEDOT, (e) PCBM, and (f) BCP films.

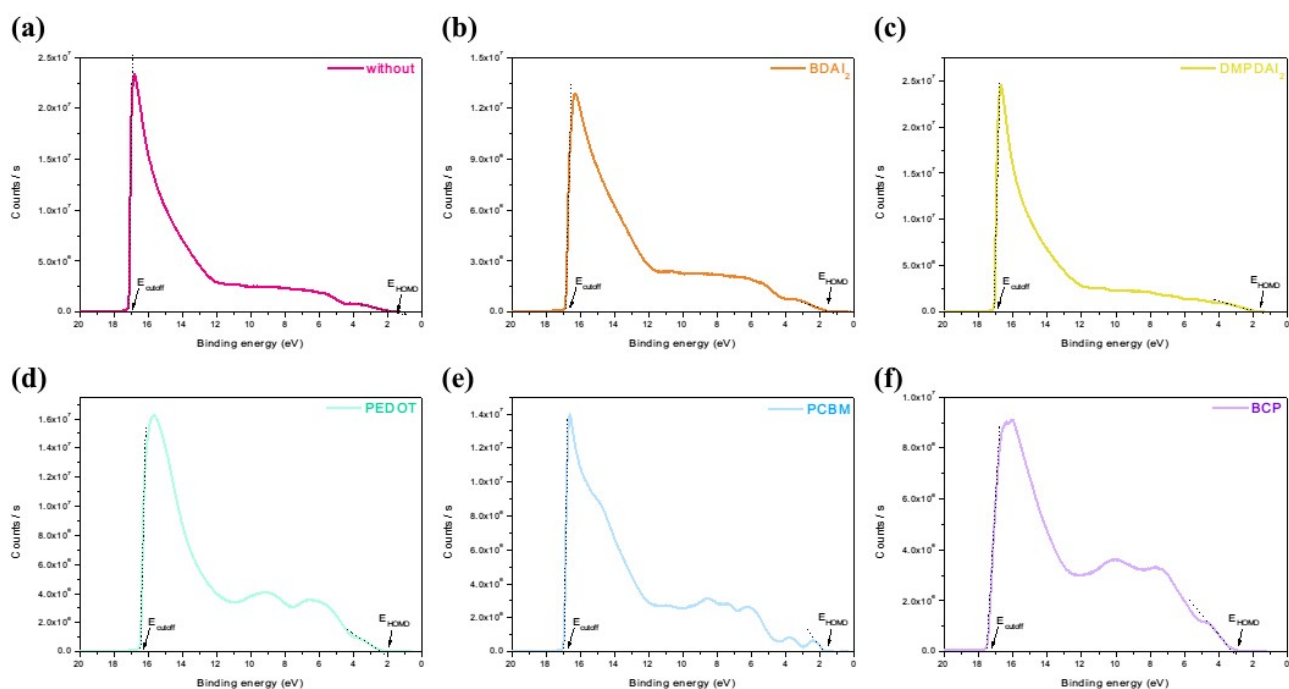


Figure S3 The UPS spectra for various perovskite solar cell (PSC) films: (a) without 2D treatment, (b) treated with BDAI₂, (c) treated with DMPDAI₂, as well as for (d) PEDOT, (e) PCBM, and (f) BCP films.

Table S1 The thickness parameters for PSCs without 2D treatment, those treated with BDAI₂, and those treated with DMPDAI₂.

	Ag(nm)	BCP(nm)	PCBM(nm)	Perovskite(nm)	PEDOT:PSS(nm)
without	88	14	48	564	30
BDAI ₂	88	14	48	567	30
DMPDAI ₂	86	17	44	567	30

Table S2 The XRD parameters for perovskite films without 2D material treatment, those treated with BDAI₂, and those treated with DMPDAI₂.

	PEAK position(2θ)	FWHM(β)	Crystallite size(nm)
without	14.01	0.007924	1055.40
BDAI ₂	14.01	0.008412	994.17
DMPDAI ₂	14.04	0.008692	962.18

Table S3 The peak areas of XPS C 1s for perovskite films without 2D material, those treated with BDAI₂, and those treated with DMPDAI₂.

	C-C	C-NH ₂	N-C=N
without	583.89	399.98	499.22
BDAI ₂	821.28	152.58	594.23
DMPDAI ₂	535.81	389.34	401.97

Table S4 Electronic parameters of different PSCs films extracted from UPS spectra.

	WF(eV)	E _{VB} (eV)	E _g (eV)	E _{CB} (eV)
PEDOT	3.95	-5.45	3.2	-2.25
Without 2D	4.01	-5.67	1.629	-4.04
BDAI ₂	4.29	-5.72	1.63	-4.09
DMPDAI ₂	4.09	-5.76	1.63	-4.13
PCBM	4.21	-5.95	2.01	-3.94
BCP	3.71	-6.92	3.85	-3.07

Table S5 The material parameters for PEDOT, PCBM, and BCP utilized in the TCAD simulation.

	PEDOT	PCBM	BCP
Relative Dielectric Permittivity	2.2	3.9	11
N_C (cm⁻³)	2×10^{21}	1×10^{22}	1×10^{19}
N_V (cm⁻³)	2×10^{21}	1×10^{22}	1×10^{19}
Mobility of electron (cm²/V-s)	1	0.01	0.02
Mobility of hole (cm²/V-s)	40	0.01	2
Lifetime of electron (s)	4×10^{-6}	4×10^{-6}	5×10^{-9}
Lifetime of hole (s)	4×10^{-6}	4×10^{-6}	2×10^{-9}