Supporting Information

Mechanism of Light-Soaking Effect in Inverted Polymer Solar Cells with Open-Circuit voltage Increase Observed

Takuji Kusumi †, Takayuki Kuwabara *†‡, Kyosuke Fujimori †, Takumi Minami †, Takahiro Yamaguchi †, Tetsuya Taima †‡, Kohshin Takahashi *†‡, Tatsuya Murakami §, Vanadian Astari Suci Atina Rachmat ‖ and Kazuhiro Marumoto ‖

†*Graduate School of Natural Science and Technology, and* ‡*Research Center for Sustainable Energy and Technology, Kanazawa University, Kakuma-machi, 920-1192 Kanazawa, Japan*
§*Center for Nanomaterials and Technology, Japan Advanced Institute of Science and Technology (JAIST), 1-1 Asahidai, 923-1292 Nomi, Japan*
‖*Division of Materials Science, University of Tsukuba, 1-1-1 Tennodai, 305-8573 Tsukuba, Japan*

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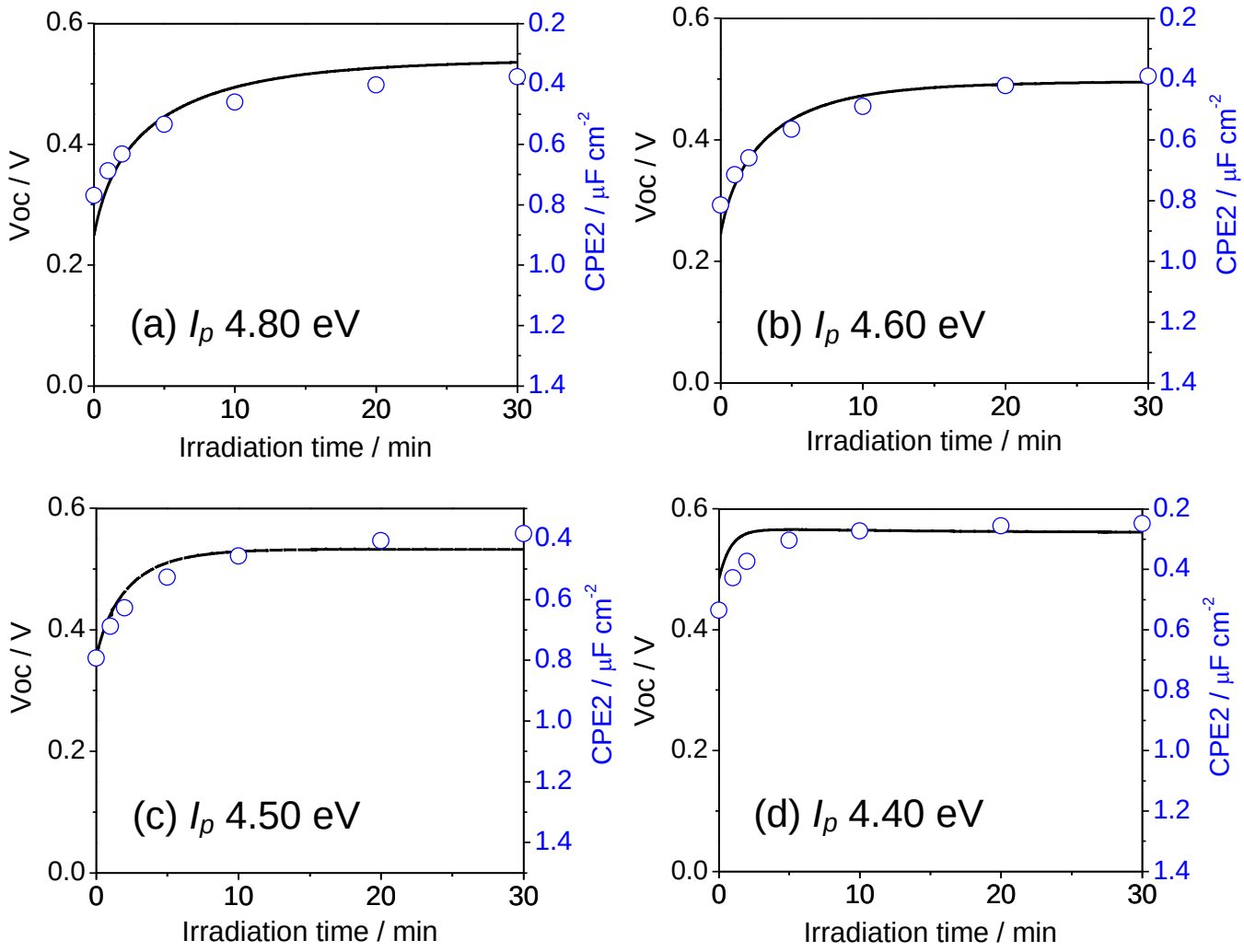

Figure S1. Time-dependence of V_{oc} (black lines) and CPE2 (blue open circles) for the inverted PSCs containing bare-ITO and various BAP-modified ITOs. I_p of the ITO electrodes; 4.80 eV (a), 4.60 (b), 4.50 (c), and 4.40 eV (d).

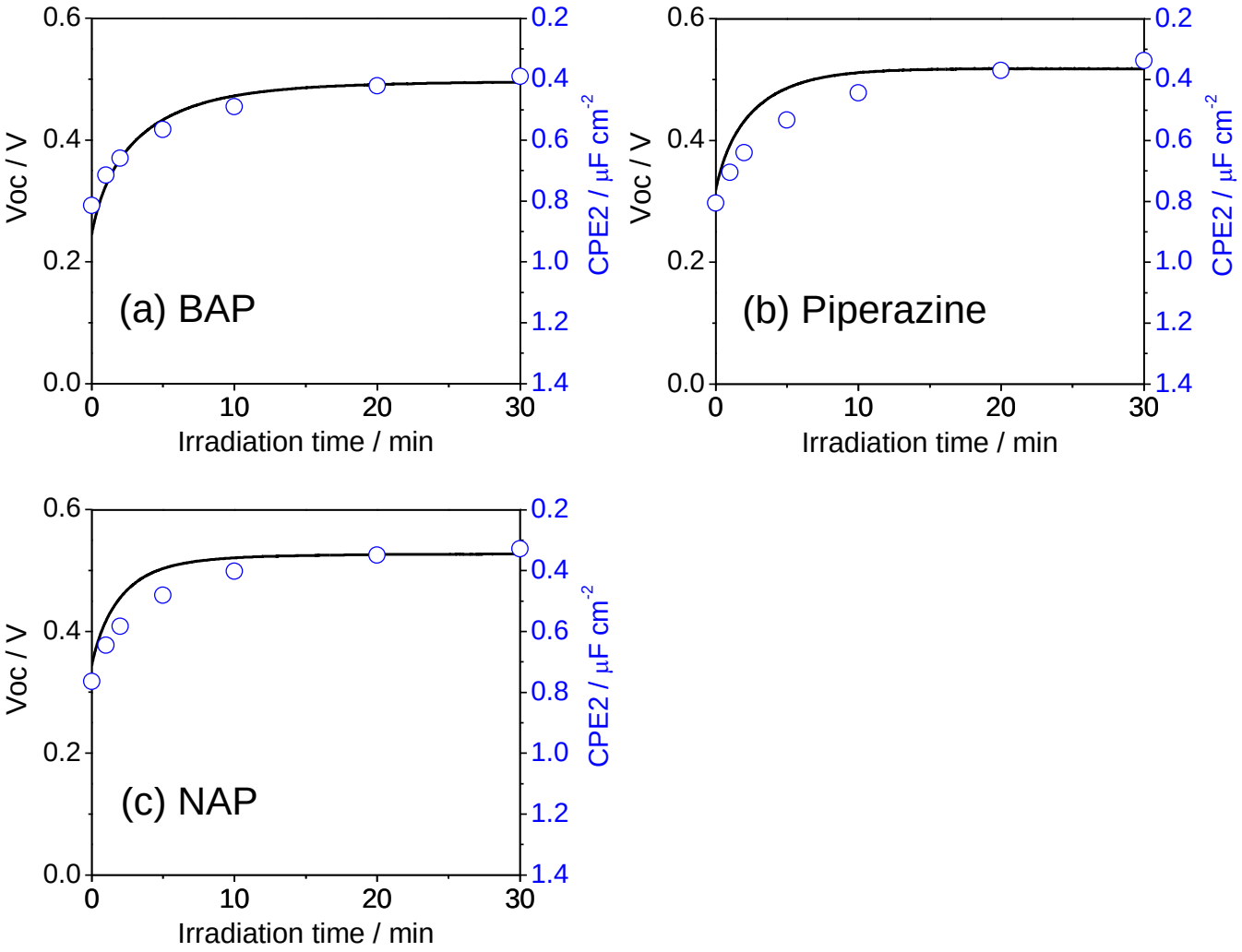

Figure S2. Time-dependence of V_{oc} (solid lines) and CPE2 (blue open circles) for the inverted PSCs containing BAP (a), piperazine (b), and NAP (c) modified ITOs with almost the same I_p values (4.60 eV).

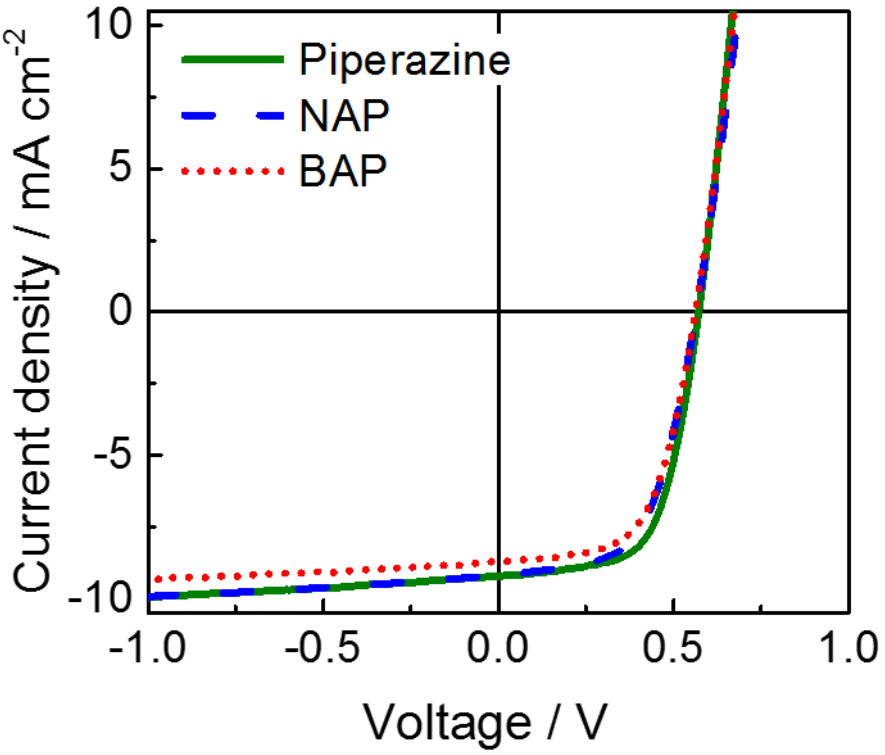

Figure S3. Photo *I-V* curves for the inverted PSCs containing piperazine, NAP, and BAP modified-ITO with almost the same I_p values (4.60 eV) after white light irradiation for 120 min.

Table S1. The differences between the initial and saturated values of V_{oc} (ΔV_{oc}) and CPE2 (ΔCPE2) for the inverted PSCs featuring piperazine, NAP, and BAP modified-ITO substrates, which had various I_p values.

Piperazine deriv.	I_p / eV	Time / min	V_{oc} / V	CPE2 / μF
BAP (0.04 M)*	4.4	0	0.48	0.448
		30	0.56	0.154
			ΔV_{oc} = 0.08	ΔCPE2 = 0.294
BAP (0.002 M)*	4.5	0	0.35	0.794
		30	0.53	0.384
			ΔV_{oc} = 0.18	ΔCPE2 = 0.410
BAP (0.00002 M)*	4.6	0	0.24	0.815
		30	0.49	0.390
			ΔV_{oc} = 0.25	ΔCPE2 = 0.425
Piperazine (0.8 M)*	4.6	0	0.32	0.806
		30	0.52	0.338
			ΔV_{oc} = 0.20	ΔCPE2 = 0.468
NAP (0.003 M)*	4.6	0	0.34	0.764
		30	0.53	0.329
			ΔV_{oc} = 0.19	ΔCPE2 = 0.435
none (bare-ITO)	4.8	0	0.25	0.840
		30	0.54	0.318
			ΔV_{oc} = 0.29	ΔCPE2 = 0.522

* Concentrations of piperazine derivatives in spin-coating solutions.

Table S2. Photovoltaic properties of inverted PSCs containing BAP-modified ITO electrodes with various I_p values after white light irradiation for 120 min.

I_p / eV	Conc. / M*	J_{sc} / mA cm^{-2}	V_{oc} / V	FF	PCE / %
4.40	4×10^{-2}	9.93	0.57	0.60	3.40
4.44	2×10^{-2}	9.25	0.57	0.64	3.37
4.45	1×10^{-2}	9.64	0.57	0.62	3.39
4.50	2×10^{-3}	9.23	0.56	0.62	3.21
4.53	2×10^{-4}	8.81	0.56	0.58	2.87
4.59	2×10^{-5}	8.72	0.56	0.60	2.95
4.80	0	7.76	0.52	0.55	2.22

* Concentrations of piperazine derivatives in spin-coating solutions.

Table S3. Photovoltaic properties of inverted PSCs featuring piperazine, NAP, and BAP modified-ITO substrates with almost the same I_p values (4.60 eV) after white light irradiation for 120 min.

Piperazine deriv.	I_p / eV	Conc. / M*	J_{sc} / mA cm^{-2}	V_{oc} / V	FF	PCE / %
Piperazine	4.53	2	9.21	0.57	0.63	3.32
NAP	4.59	3×10^{-3}	9.18	0.57	0.59	3.08
BAP	4.59	2×10^{-5}	8.72	0.56	0.60	2.95