

Supplementary Information

Molecular gel-mediated UV-to-visible spectral conversion for enhancement of power-conversion efficiency

Hirokuni Jintoku,¹ and Hirotaka Ihara^{1,2,*}

¹ Department of Applied Chemistry and Biochemistry, Kumamoto University, Kumamoto 860-8555, Japan

² Kumamoto Institute for Photo-Electro Organics (PHOENICS), Kumamoto, 862-0901, Japan

1. Materials and Generals

5 x 5 cm Amorphous silicon solar cell (YG-B5050) was purchased from Shenzhen Global Solar Energy Technology Co., Ltd. Polystyrene (Mw: ~280,000) was purchased from Aldrich. Pyrene, Diethylene glycol (DEG) and benzene were purchased from Nacalai tesque. *N*¹,*N*⁵-didodecyl-L-glutamide (**g**)¹ and pyrene lipid (**g-Pyr**)² were synthesized by the previously reported procedure with slight modification. UV-visible, CD and fluorescence spectra were measured with V-560 (JASCO), J725 (JASCO) and FP-6500 (JASCO), respectively. The photocurrent was measured under AM 1.5G illumination at 100 mW/cm² under a XES-70S1 (SAN-EI ELECTRIC) solar simulator (7 x 7 cm photo-beam size).

2. SCFs Preparation for I-V measurement

- (1) The pyrene-functionalized L-glutamide (**g-Pyr**) as an organogelator was dissolved in a hot benzene solution together with polystyrene (PS) to be a clear solution.
- (2) When this mixed solution was casted on an a-Si cell and dried for 1 h at 25°C, a clear film was obtained on the top of a-Si cell.
- (3) For decreasing the reflection due to surface roughness, the glass was put on to the covered cell using diethylene glycol (DEG) as an index matching optical buffer (n = 1.45).
- (4) For standard, the I-V curve of bare cell was measured using non-coated a-Si cell with glass and DEG.

1. H. Ihara, M. Yoshitake, M. Takafuji, T. Yamada, T. Sagawa, C. Hirayama and H. Hachisako, *Liq. Cryst.*, 1999, **26**, 1021–1027.
2. M. Takafuji, Y. Kira, H. Tsuji, S. Sawada, H. Hachisako and H. Ihara, *Tetrahedron*, 2007, **63**, 7489–7494.

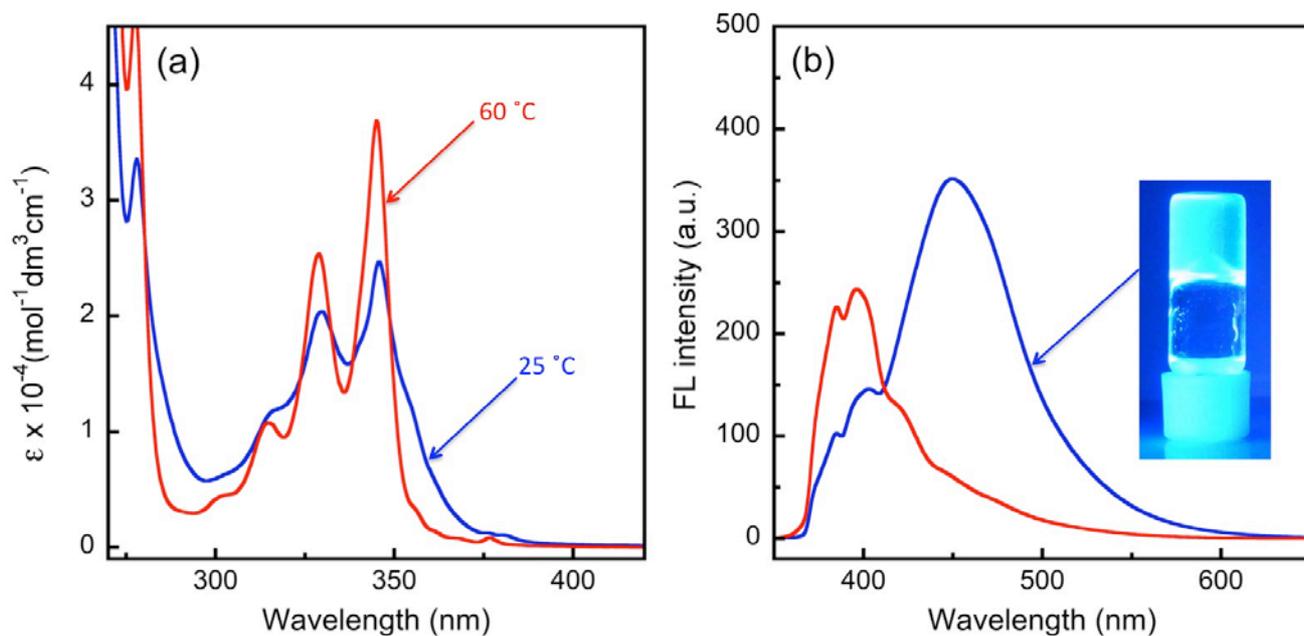


Figure S1. (a) UV-vis and (b) fluorescence spectra of 0.5 mM of *g*-Pyr in benzene at 25 °C (blue line) and 60 °C (red line). Excitation wavelength is 350 nm (a) and 360 nm (b). The inset picture is photo-image of *g*-Pyr benzene gel (4 mM) at 25 °C.

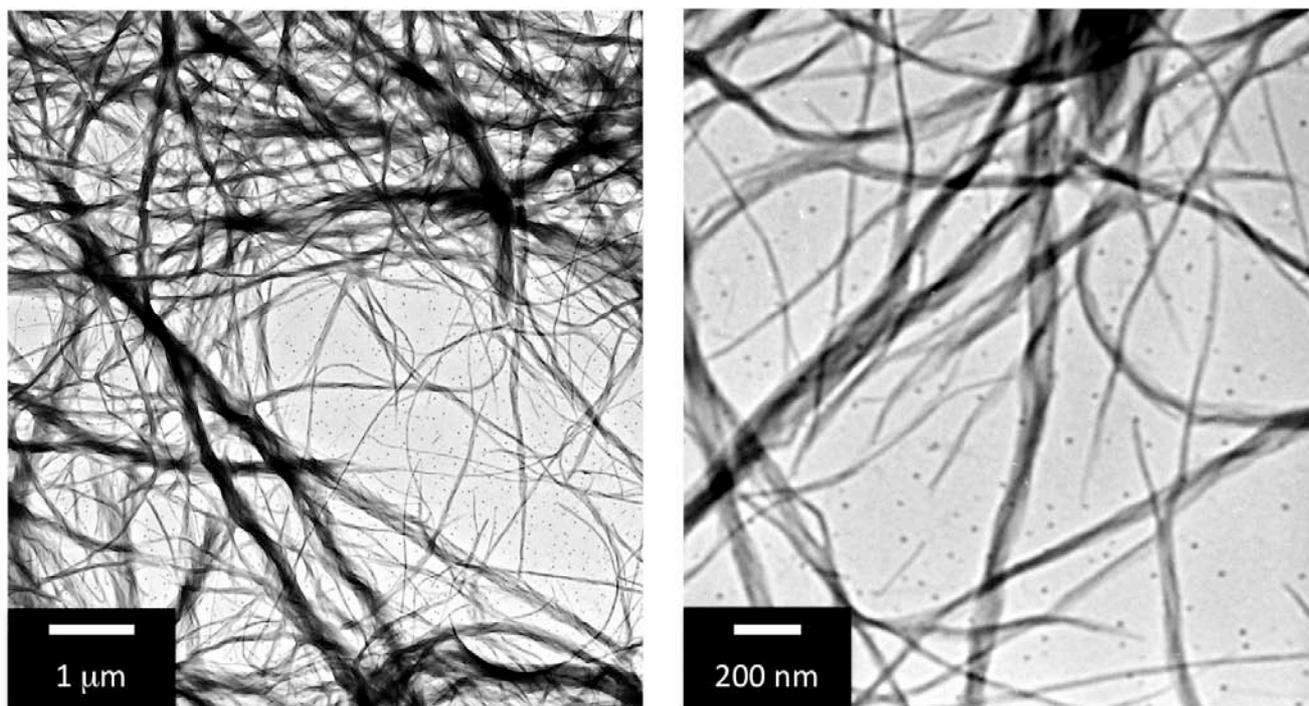


Figure S2. TEM images of *g*-Pyr aggregates that was prepared from 0.5 mM of benzene solution at 10 °C. It was stained by saturated uranyl acetate.

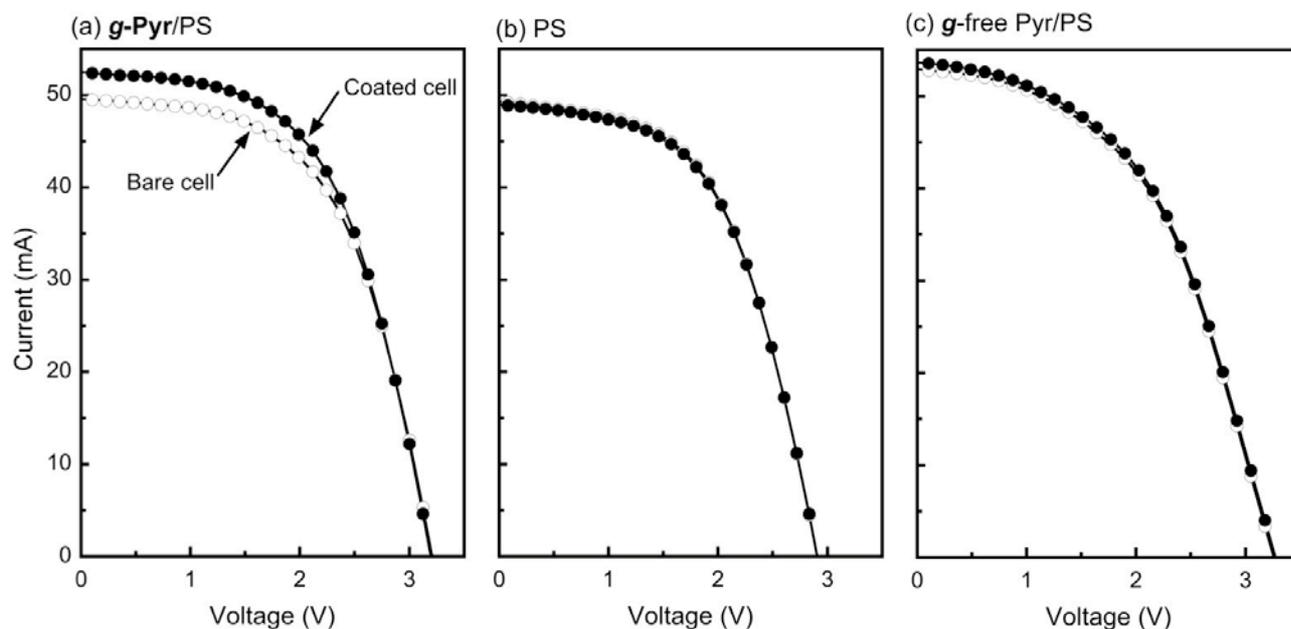


Figure S3. I-V curves of an a-Si solar cell before (open circle) and after (solid circle) surface coating by (a) *g*-Pyr/PS film, (b) PS film and (c) *g*-free Pyr/PS film.

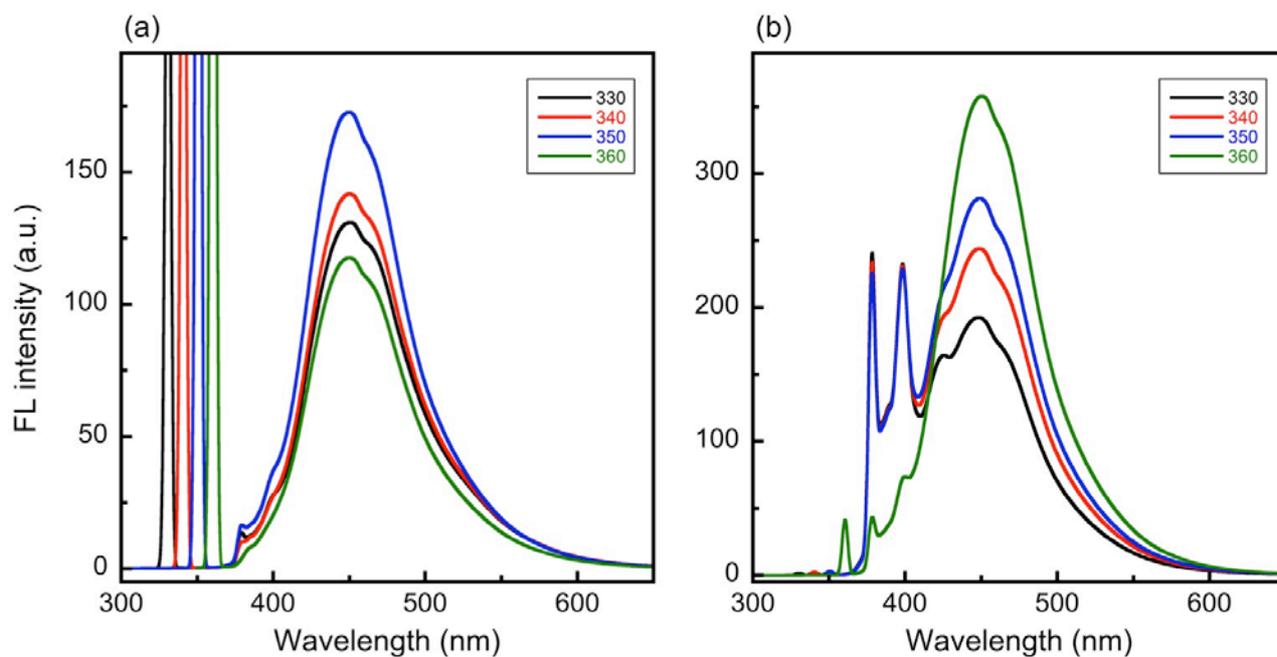


Figure S4. Excitation wavelength dependence of fluorescence spectra of (a) *g*-Pyr/PS film and (b) *g*-Pyr benzene solution (0.5 mM) at 10 °C. Excitation wavelengths were 330 nm (black line), 340 nm (red line), 350 nm (blue line), and 360 nm (green line).

Table S1 Comparison of the short circuit current (I_{SC}), open voltage (V_{OC}), fill factor (FF) and power-conversion efficiency (η) of the bare and modified a-Si cells

		PS	Pyr-PS	gPyr-PS
I_{SC} (mA)	Bare cell	49.28	52.27	48.84
	Modified cell	49.15	53.41	52.21
	Increase (%)	-0.3	2.2	6.91
V_{OC} (V)	Bare cell	2.90	3.26	3.18
	Modified cell	2.91	3.28	3.20
	Increase (%)	0.40	0.67	0.77
FF	Bare cell	0.54	0.49	0.56
	Modified cell	0.54	0.49	0.56
	Increase (%)	0	0	0
η (%)	Bare cell	3.11	3.36	3.55
	Modified cell	3.11	3.42	3.74
	Increase (%)	-0.1	1.75	5.35