Supporting information

Designing Novel Poly(oxyalkylene)-segmented Ester based Polymeric Dispersants for Efficient TiO_2 Photoanodes of Dye-sensitized Solar Cells

Yow-An Leu[a,b§], *Yen-An Lu*[b,c§], *Min-Hsin Yeh*[d*], *Po-Ta Shih*[a], *Sheng-Yen Shen*[a],

Kuo-Chuan Ho[a,b,c*], *and Jiang-Jen Lin*[a,c*]

[a] Institute of Polymer Science and Engineering, National Taiwan University, Taipei 10617, Taiwan

[b] Department of Chemical Engineering, National Taiwan University, Taipei 10617, Taiwan

[c] Advanced Research Center for Green Materials Science and Technology, National Taiwan University, Taipei 10617, Taiwan

[d] Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei 10607, Taiwan

***Corresponding Author**

E-mail: mhyeh@mail.ntust.edu.tw, Tel: +886-2-2737-6643 (M.H. Yeh);

E-mail: kcho@ntu.edu.tw, Tel: +886-2-2366-0739 (K.C. Ho);

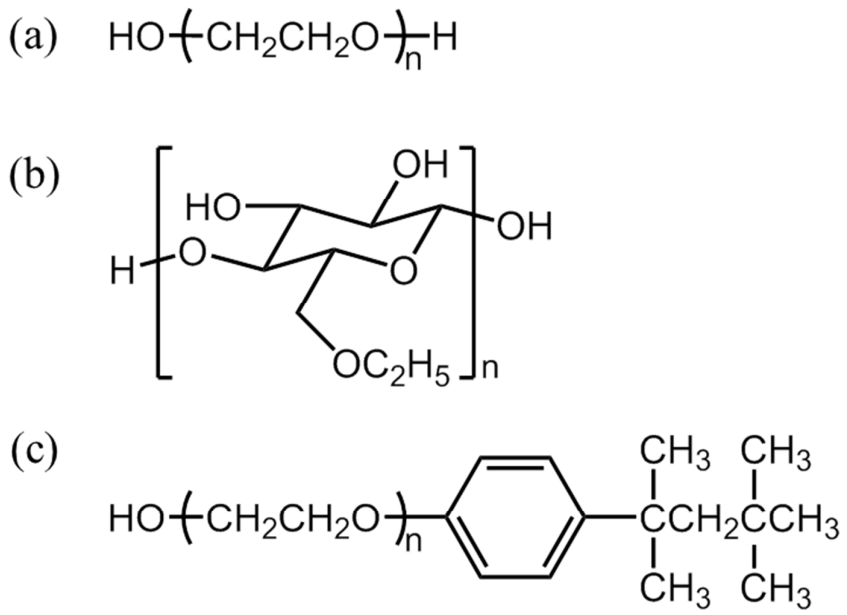
E-mail: jianglin@ntu.edu.tw, Tel: +886-2-3366-5316 (J.J. Lin)

Table S1 Kinetic analyses on PTT-B600, PTT-B1000, and PTT-B2000 with respect to molecular weight and acid value (AV), and the corresponding performance for TiO_2 dispersion.

Polymer addictive	Reaction time (h)	AV	$M_{W,GPC}$ (g/mol)	Mean diameter (nm)	Particle size (nm) & distribution (%; bimodal peaks)
No dispersant	-	-	-	2100	910/5980-(77/23)
Commercial PEG	-	-	20,000	1500	1520-(100)
PTT-B600	0.5	82.0	6,800	1500	1500-(100)
	0.75	59.1	16,000	760	140/810-(7/93)
	1	-	Gel	-	-
PTT-B1000	0.5	87.1	3,600	470	180/640-(36/64)
	1	73.9	5,000	410	130/460-(15/85)
	1.5	66.8	7,200	280	110/380-(36/64)
	2	54.0	12,000	170	87/320-(50/50)
	3	-	Gel	-	-
PTT-B2000	0.5	63.7	3,600	700	180/750-(9/91)
	1	61.0	4,400	390	150/420-(13/87)
	1.5	57.2	5,400	320	140/610-(49/51)
	2	54.5	7,700	190	98/400-(69/31)
	3	49.6	11,000	220	88/390-(57/43)
	4	42.2	16,000	360	100/620-(51/49)
	5	35.3	19,000	990	140/1200-(20/80)
	6	30.7	21,000	1200	160/1600-(28/72)
	7	-	Gel	-	-

Table S2 Photovoltaic parameters of the DSSCs with the photoanode of TiO_2/PEG and TiO_2/PTT-B1000 films, under various film thicknesses (100 mW cm^{-2}, AM 1.5G).

TiO_2 photoanode	Thickness (μm)	V_{oc} (V)	J_{sc} (mA cm^{-2})	FF	η (%)
TiO_2/PEG	10.3	0.685	13.5	0.65	6.02
	17.5	0.685	15.0	0.64	6.55
	28.9	0.699	16.1	0.64	7.18
	41.8	0.713	14.2	0.64	6.50
TiO_2/PTT-B1000	9.24	0.697	14.5	0.60	6.07
	13.9	0.711	15.5	0.65	7.21
	19.4	0.707	18.0	0.62	7.88
	25.8	0.707	18.7	0.63	8.28
	31.4	0.689	18.0	0.62	7.61



Scheme S1 Chemical structures of the conventional binders and dispersants for TiO_2 paste: (a) polyethylene glycol (PEG), (b) ethyl cellulose (EC), and (c) Triton™-X100.

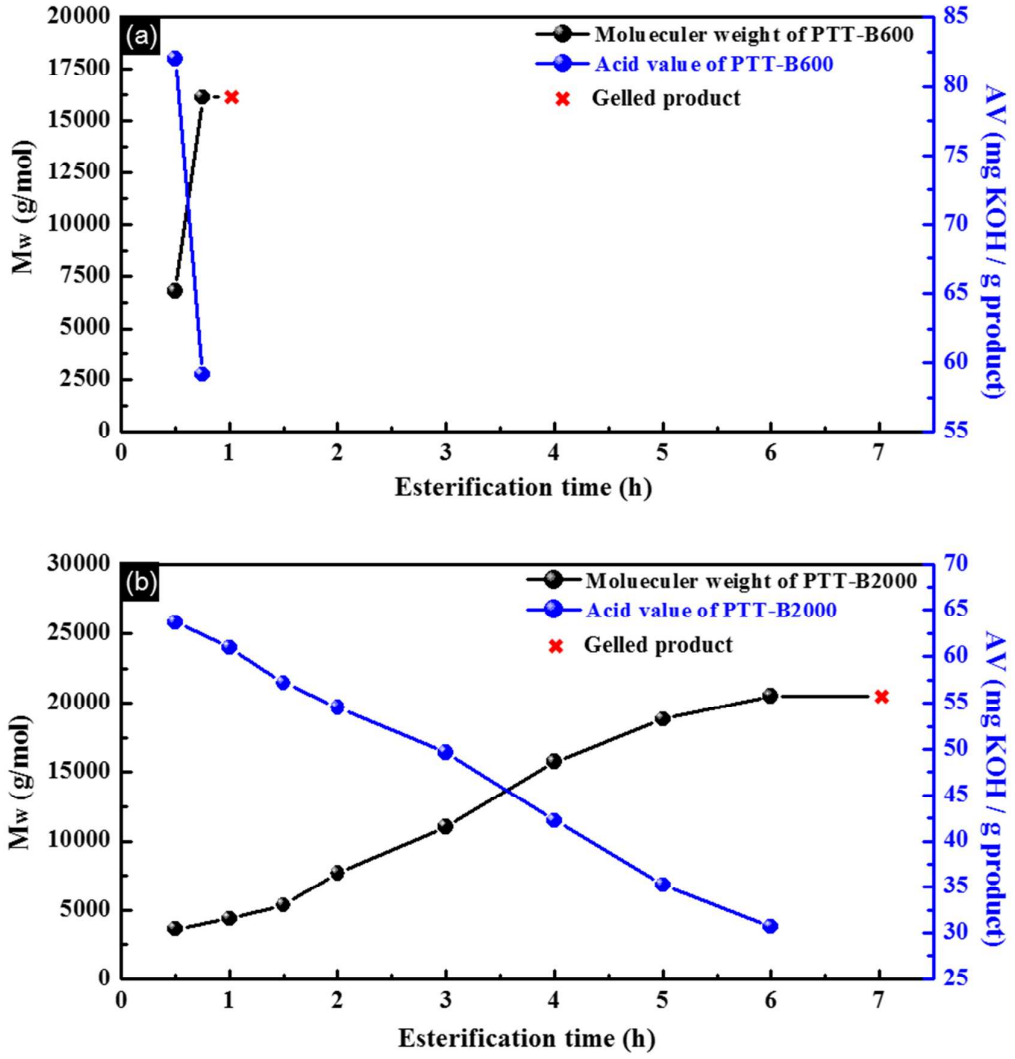


Fig. S1 Relative reaction profile of the synthesis, (a) PTT-B600 and (b) PTT-B2000 by monitoring molecular weight and acid value during esterification.

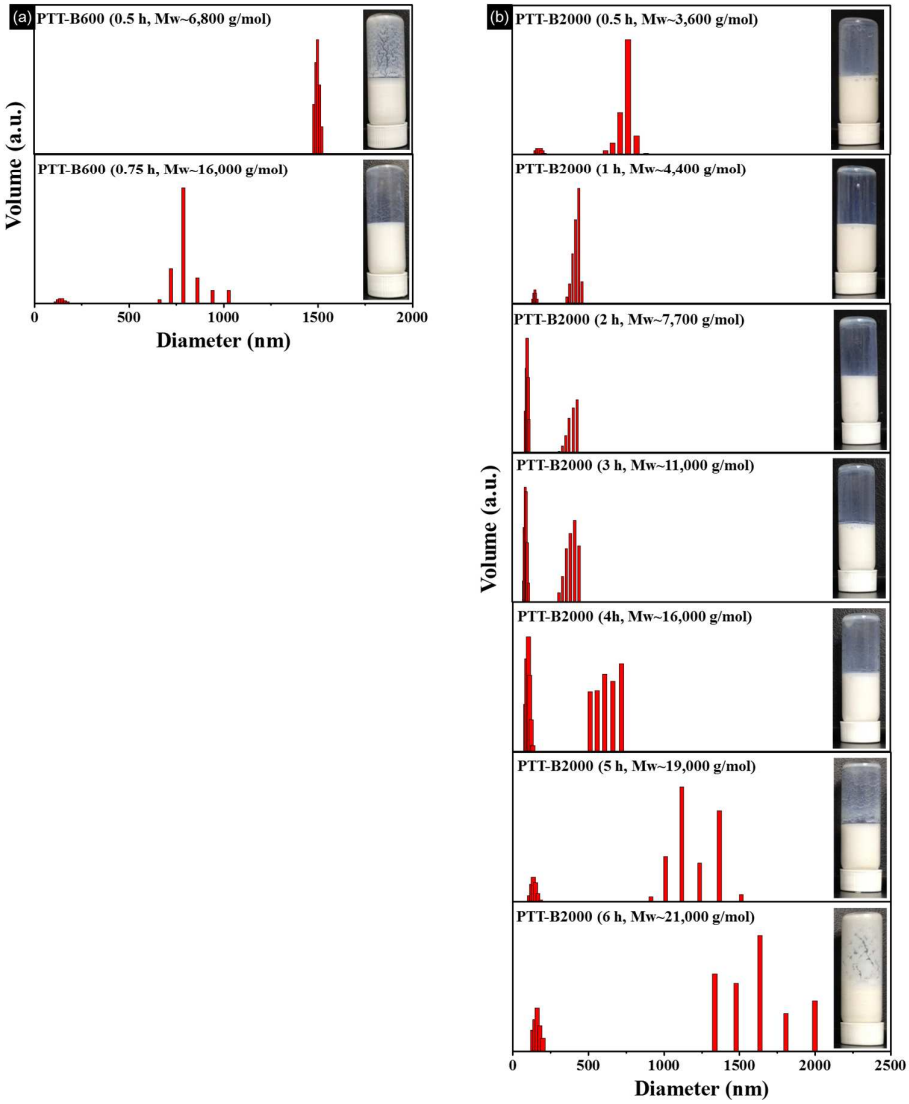


Fig. S2 Particle sizes and bimodal distribution of TiO_2 dispersion with (a) PTT-B600 and (b) PTT-B2000 with different Mw.

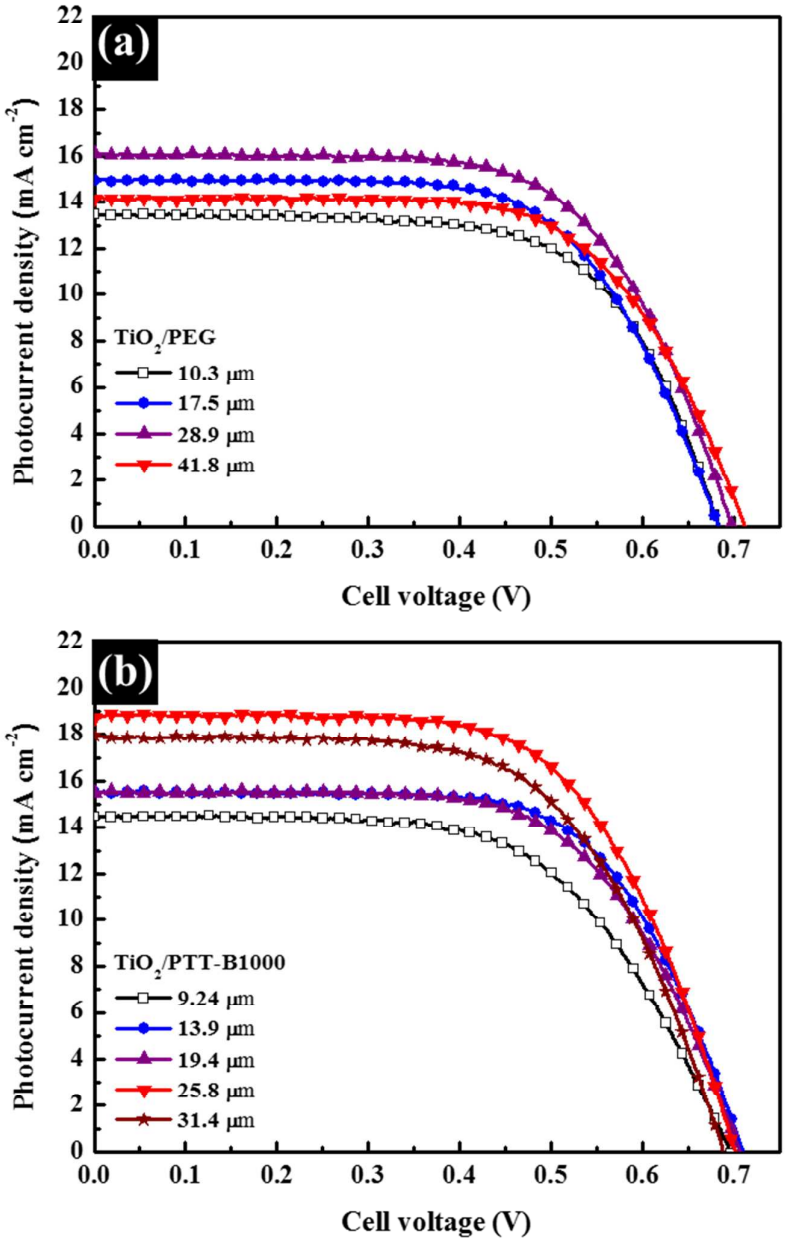


Fig. S3 *J-V* curves of DSSCs with (a) TiO_2/PEG and (b) TiO_2/PTT-B1000 films on the WEs with various thicknesses under illumination of 100 mW cm^{-2}