Supporting Information

High-efficiency Solid-state Polymer Electrolyte Dye-sensitized Solar Cells with a Bi-functional Porous Layer

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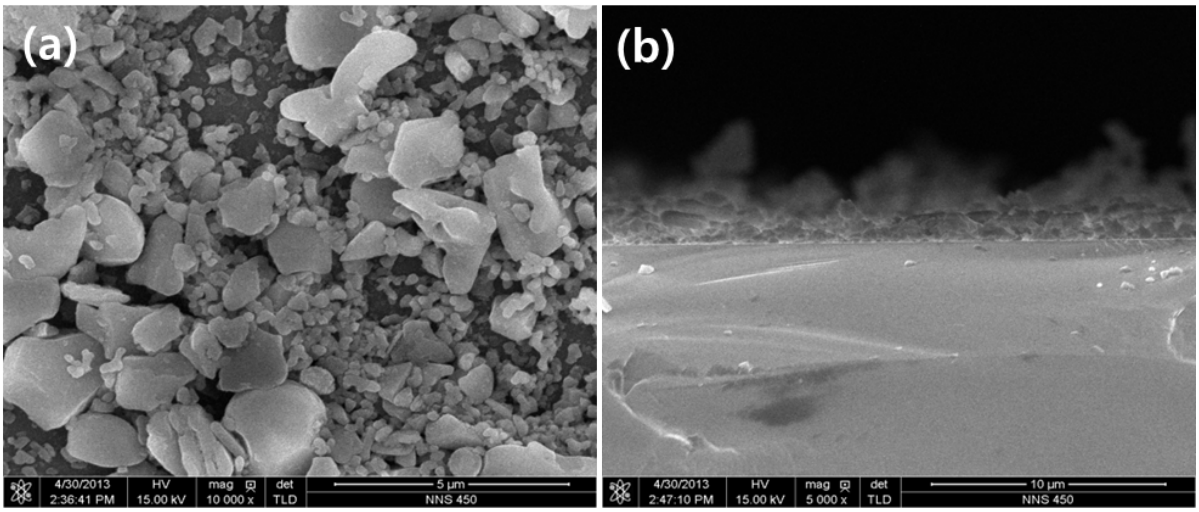

Fig. S1. SEM image of an alumina scattering layer (a) top-view and (b) cross-section.

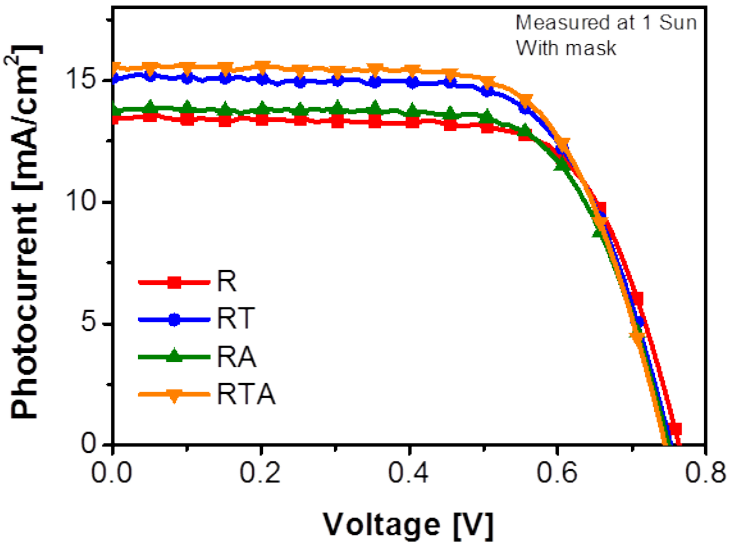

Fig. S2. IV characteristics from different electrodes of transparent TiO_2 and those with and without alumina and a TiO_2 scattering layer.

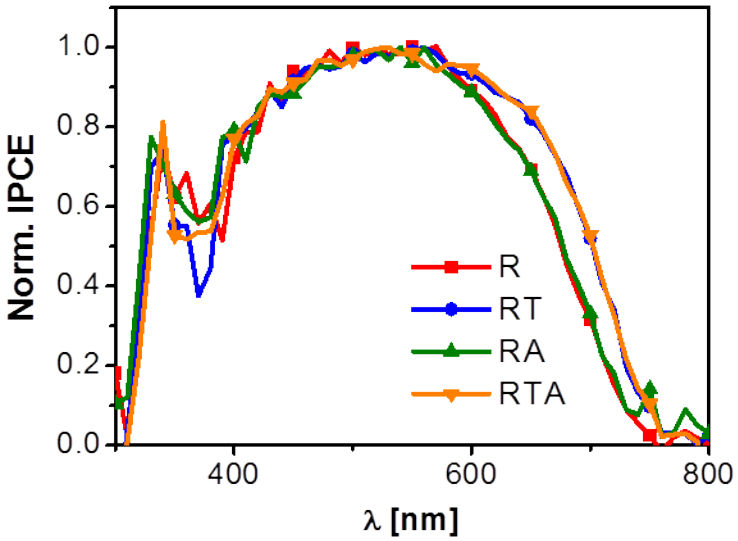

Figure S3. IPCE spectra of DSCs with a transparent reference TiO_2 (**R**) without a scattering layer and with alumina (**A**) and titania (**T**) layers.

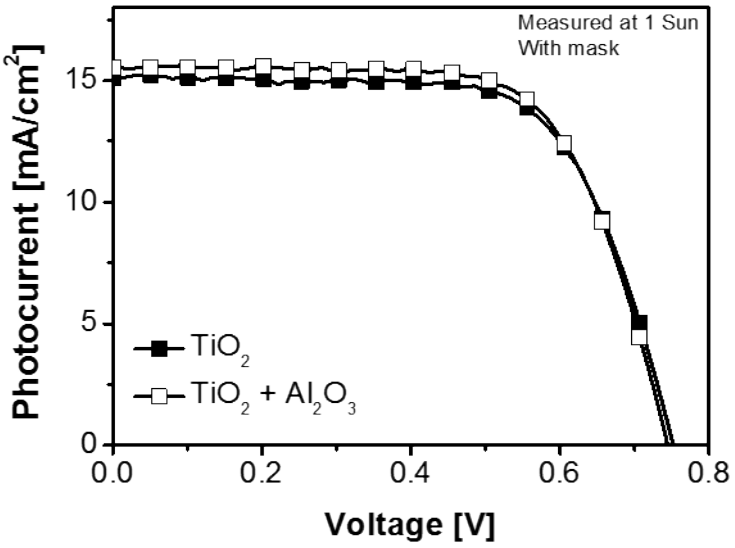

Fig. S4. IV characteristics from different electrodes of transparent TiO_2 and those with and without alumina based on liquid electrolyte.

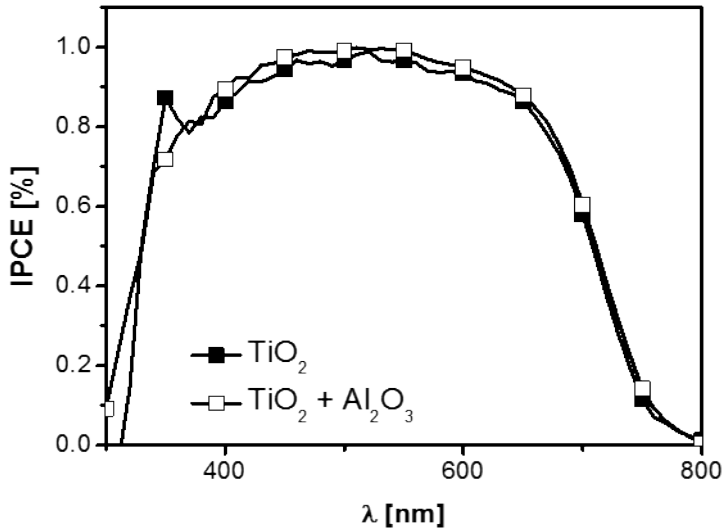

Figure S5. Normalized IPCE spectra of DSCs from different electrodes of transparent TiO_2 and those with and without alumina based on liquid electrolyte.

Table S1. Photovoltaic performance of DSCs based on liquid electrolyte and an SPE using an alumina layer with varying thickness of spacer.

Electrolyte	Symbol	Spacer/μm	V_{OC}/V	J_{SC}/mAcm^{-2}	FF	Eff./%
Liquid	**L**	25	0.70	17.5	0.73	9.0
Polymer	**P0**	0	0.72	16.5	0.69	8.2
	P10	25	0.73	15.7	0.70	8.0
	P45	60	0.74	14.5	0.69	7.4

Table S2. Photovoltaic performance of DSCs based on different electrodes of transparent TiO_2 and those with and without alumina and a TiO_2 scattering layer.

Electrode	V_{OC}/V	J_{SC}/mAcm^{-2}	FF	Eff./%
R (Ref)	0.76	13.5	0.70	7.2
RA (Ref+Al_2O_3)	0.75	13.8	0.70	7.2
RT (Ref+TiO_2)	0.75	15.1	0.68	7.7
RTA (Ref+TiO_2+Al_2O_3)	0.75	15.5	0.68	7.9

Table S3. Photovoltaic performance of liquid electrolyte based-DSCs based on different electrodes of transparent TiO_2 and those with and without alumina.

Electrode	V_{OC}/V	J_{SC}/mAcm^{-2}	FF	Eff./%
TiO_2	0.75	15.1	0.68	7.7
$TiO_2 + Al_2O_3$	0.75	15.5	0.68	7.9