

Supporting Information

Microwave-solvothermal synthesis of different TiO_2 nano-morphologies with perked up efficiency escorted by incorporating Ni nanoparticle in electrolyte for dye sensitised solar cells

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Note: This supplementary information contains supplementary Figures S1 to S5 and Table S1 to S4.

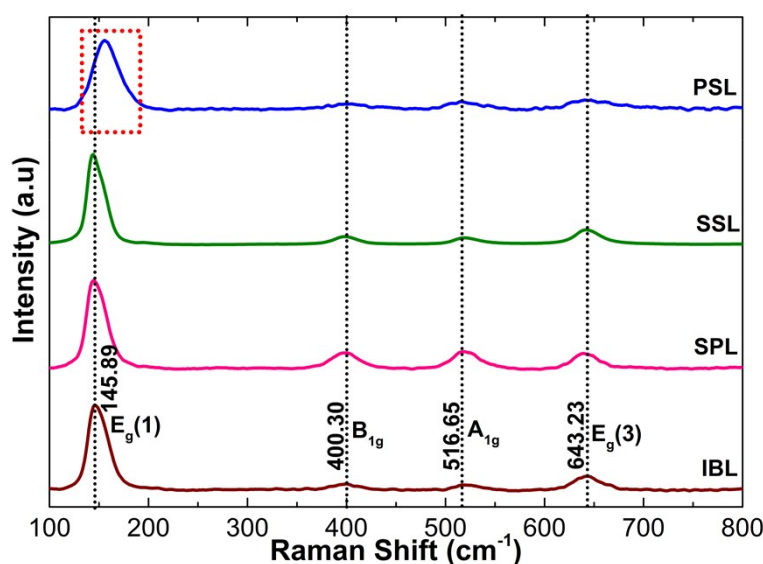


Figure S1. Raman Spectra of TiO_2 samples prepared at various MW-ST conditions.

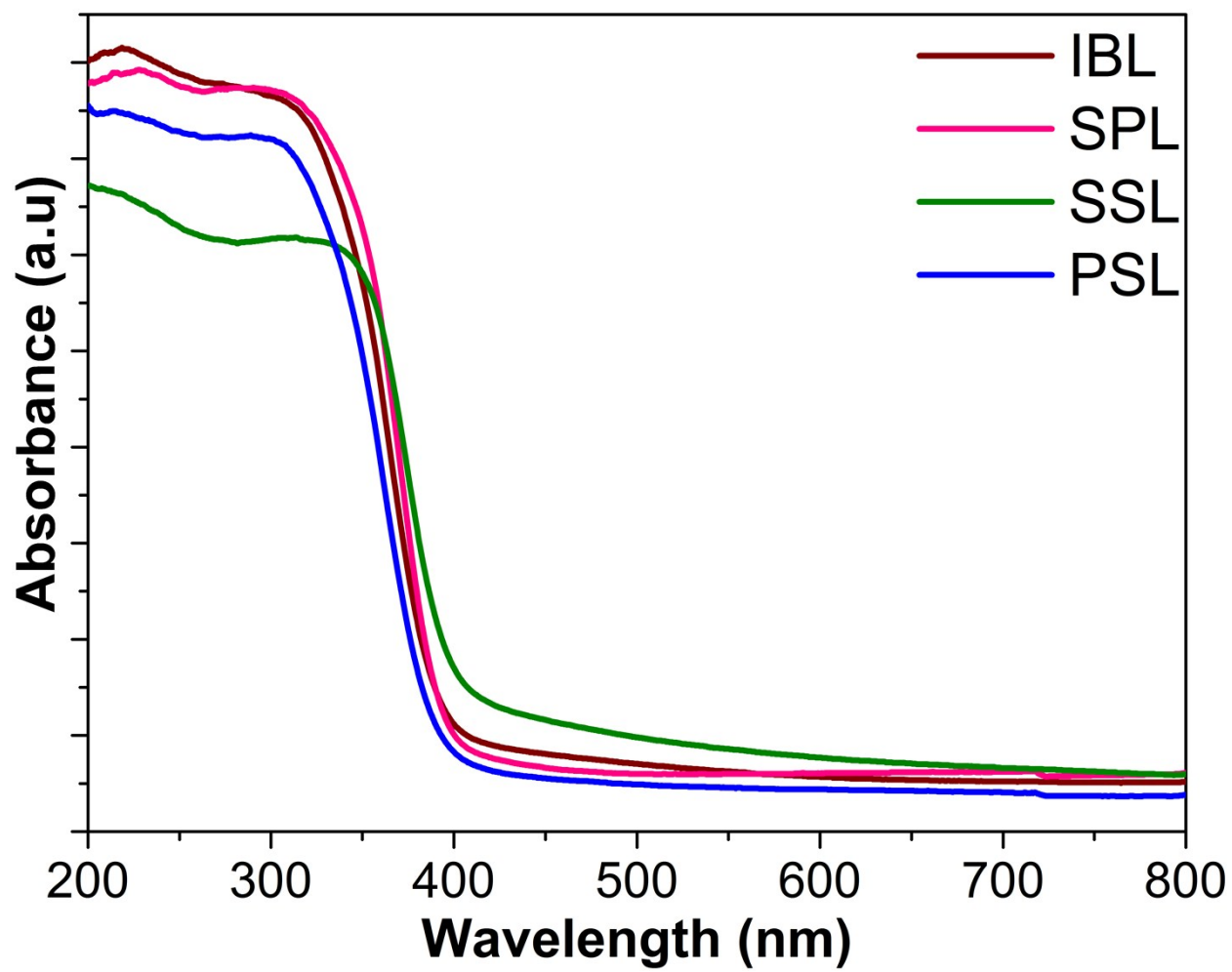


Figure S2. Diffuse Reflectance Spectra of TiO₂ samples prepared under various MW-ST reaction conditions.

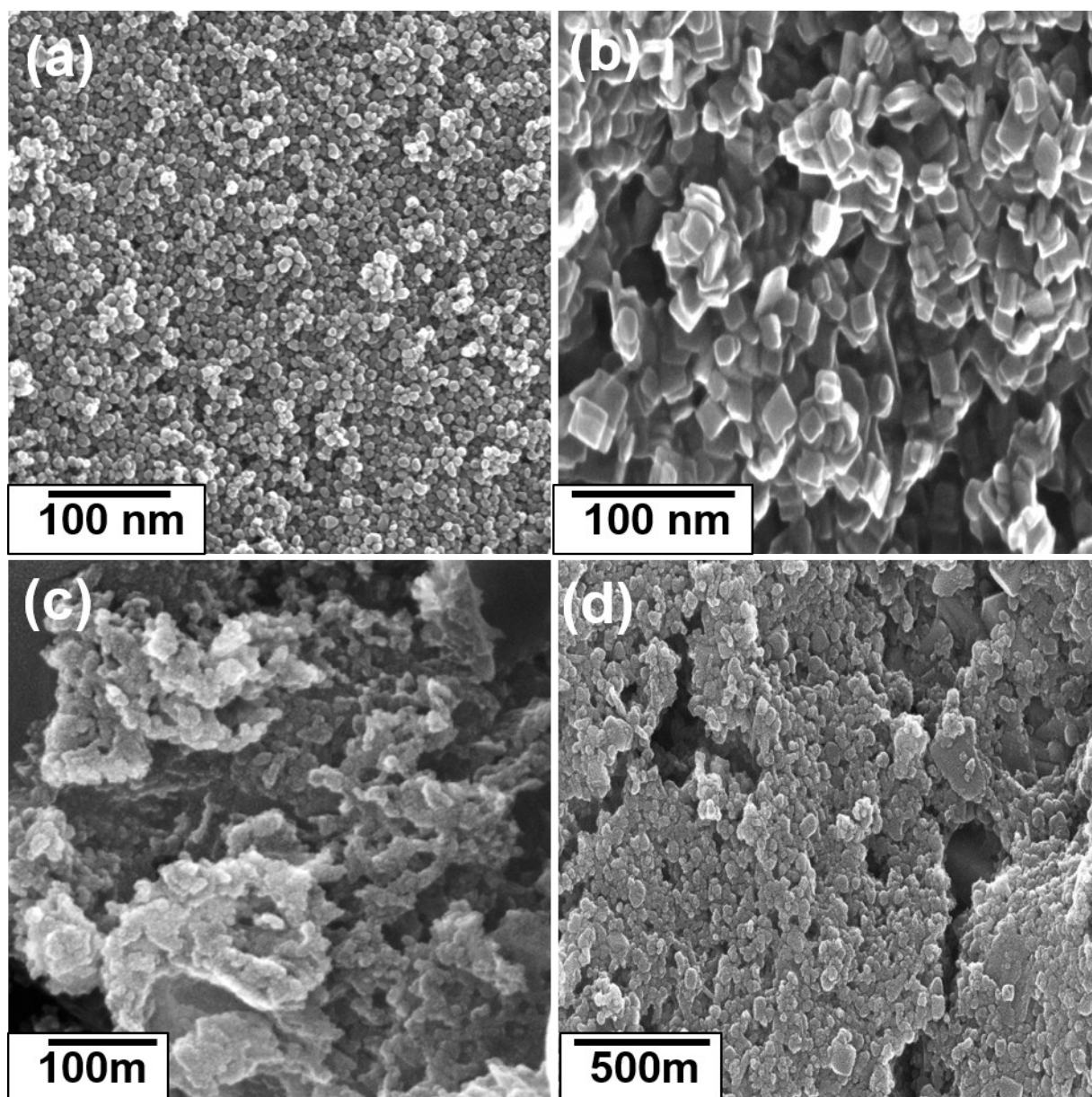


Fig.S3. FE-SEM top-view image of different thin-films of TiO_2 nanocrystals with (a) IBL (b) SPL (c) SSL and (d) PSL showing the retention of surface morphology after the photoanode formation.

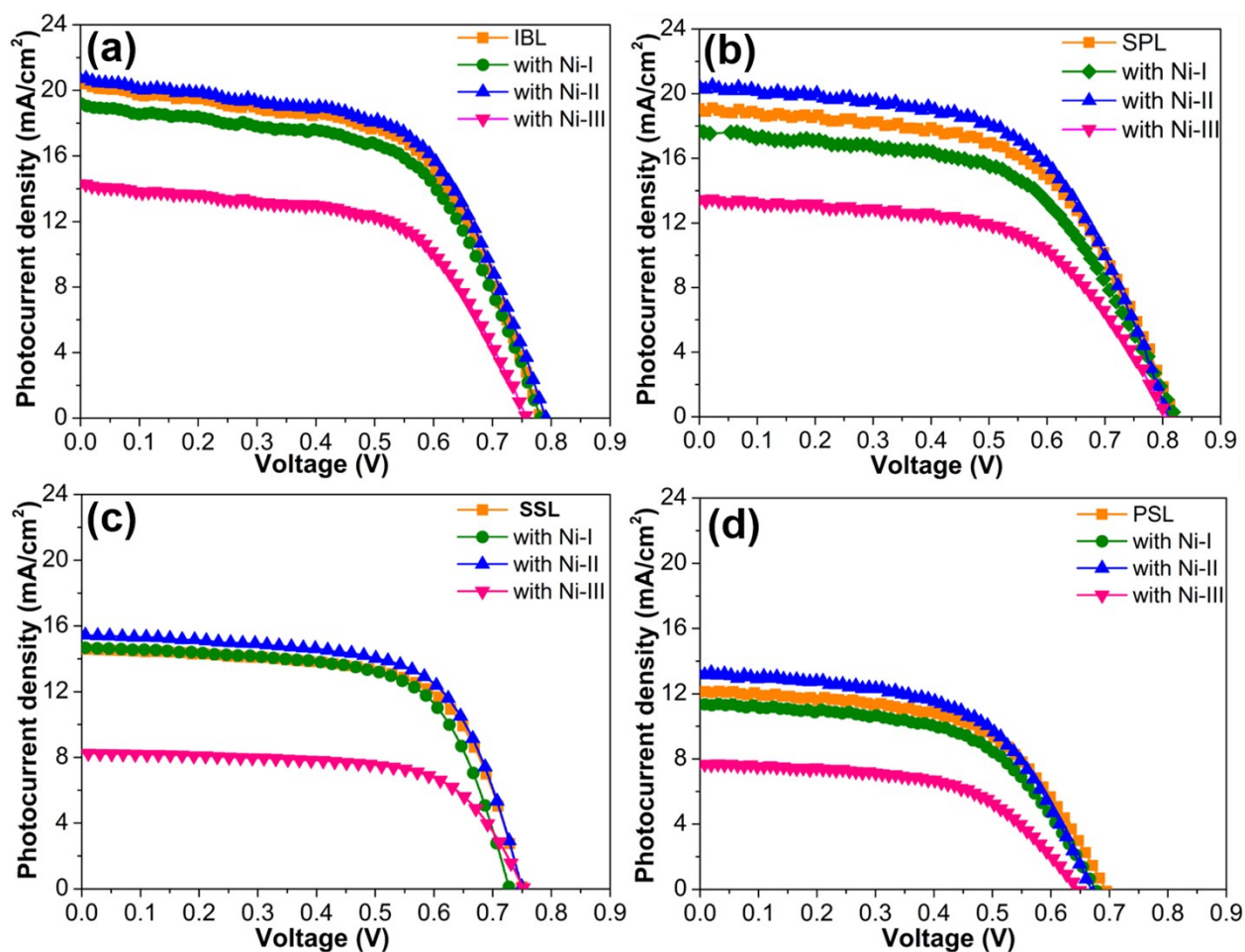


Figure S4. Comparative plot of J - V behavior of DSSCs fabricated with different Ni nanoparticles (Ni-I, Ni-II, Ni-III) incorporated in 1mg/mL of redox electrolyte for (a) IBL-TiO₂ (b) SPL-TiO₂ (c) SSL-TiO₂ (d) PSL-TiO₂.

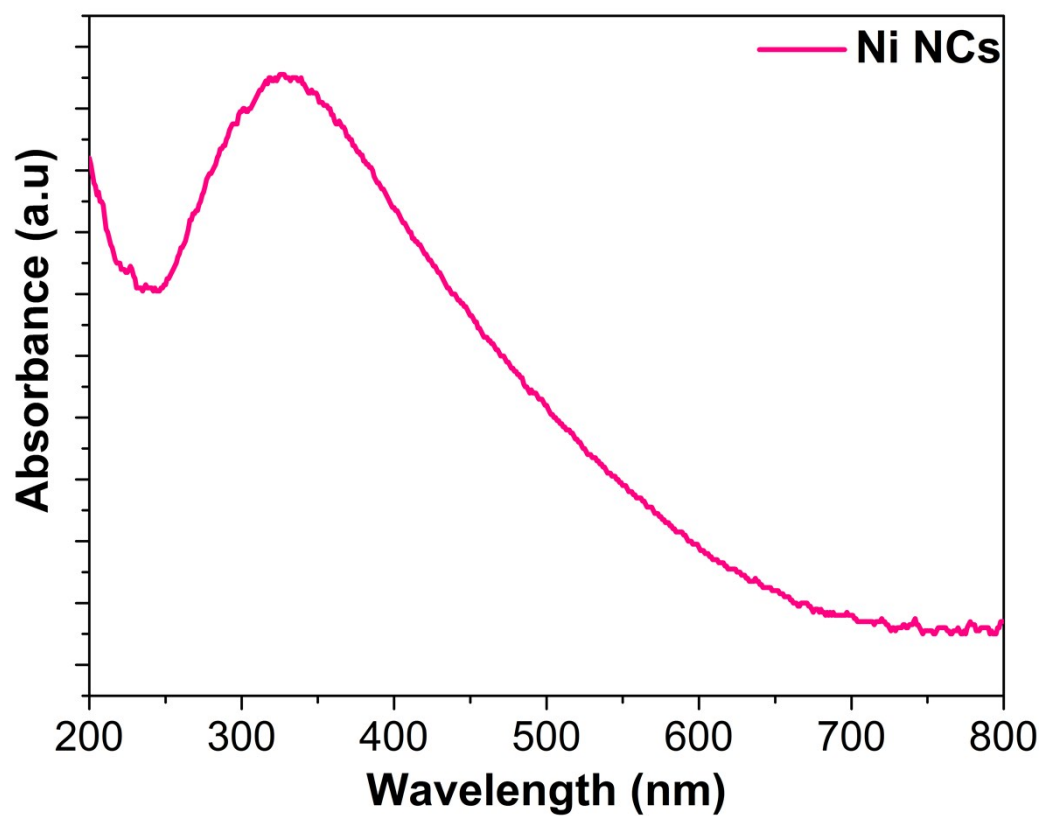


Figure S5. Diffuse Reflectance Spectra of Ni-NCs sample of size distribution 40-50 nm prepared under MW-ST method showing broad absorption for 300-650 nm.

Table S1: Summarized different MW-ST reaction conditions (different precursor, solvent, temperature and time) to prepare different TiO₂ nanocrystals for DSSC photoanode application.

Sample code	Precursor	Solvent	MW-ST Reaction condition
IBL	Ti(OBu) ₄ , CH ₃ COOH	Ethanol Water	+ 200 °C, 10 min ramp 10 min hold
SPL	Ti(OBu) ₄ , HF	HF	180 °C, 10 min ramp 10 min hold
SSL	P25, NaOH	Ethanol Water	+ 180 °C, 10 min ramp 10 min hold
PSL	Ti(OBu) ₄ , H ₂ C ₂ O ₄	Ethanol	200 °C, 10 min ramp 10 min hold

Table S2: Summarized different MW-ST reaction conditions (precursor, solvent, temperature and time) to prepare different Ni NCs for DSSC photoanode application.

Size In nm	Ni concentration	precursor Solvent	MW-ST Reaction condition
15-20	3.9 mg	EG	220 °C, 10 min ramp 15 min hold
40-50	5.8 mg	EG	220 °C, 10 min ramp 15 min hold
50-62	7.8 mg	EG	220 °C, 10 min ramp 15 min hold

Table S3: DSSC photovoltaic performance data determined by photocurrent density-voltage (J - V) characteristics analysis of five sets of each TiO₂ nanocrystals prepared by MW-ST methods.

Cell	J_{sc} (mA/cm ²)	V_{oc} (V)	J_{max} (mA/cm ²)	V_{max} (V)	FF	PCE (%) ($\pm 0.02\%$)	BET surface area (m ² g ⁻¹)
IBL	20.38	0.78	16.05	0.58	58.69	9.33	50.24
SPL	19.09	0.82	15.35	0.59	57.62	9.02	42.16
SSL	14.59	0.75	12.19	0.59	65.57	7.17	22.46
PSL	13.13	0.72	10.63	0.50	56.31	5.30	95.74

Table S4: DSSC photovoltaic performance data determined by photocurrent density-voltage (J - V) characteristics analysis of five sets of each TiO₂ nanocrystals with different size controlled Ni NCs of size 15-20 nm (**Ni-I**) 40-50 nm and (**Ni-II**) 50-62 (**Ni-III**) impregnated into redox electrolyte.

Cell	J_{sc}	V_{oc}	J_m	V_m	FF	PCE
IBL	20.24	0.78	17.01	0.55	59.12	9.33
IBL+ Ni-I	19.09	0.78	15.31	0.57	58.61	8.73
IBL+ Ni-II	20.79	0.79	16.53	0.58	58.37	9.59
IBL+ Ni-III	14.21	0.76	11.24	0.56	58.28	6.29
SPL	19.16	0.82	15.36	0.59	57.68	9.06
SPL + Ni-I	17.67	0.81	14.11	0.58	57.18	8.18
SPL + Ni-II	19.82	0.81	16.45	0.58	57.77	9.54
SPL + Ni-III	13.51	0.80	10.84	0.58	58.17	6.29
SSL	14.55	0.76	12.19	0.59	65.04	7.19
SSL + Ni-I	14.67	0.73	12.31	0.57	65.52	7.02
SSL + Ni-II	15.37	0.75	12.95	0.58	65.16	7.51
SSL + Ni-III	8.36	0.75	6.98	0.58	64.57	4.05
PSL	12.01	0.69	9.65	0.49	57.06	4.73
PSL + Ni-I	11.39	0.68	9.03	0.48	55.96	4.33
PSL + Ni-II	13.23	0.67	10.64	0.47	56.42	5.00
PSL + Ni-III	7.71	0.64	6.10	0.46	56.87	2.81
