Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supporting Information

Solar-responsive zinc oxide photo anode for solar-photon-harvester PEC Cell

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1.1 SPPS deposition methodology and related parameter optimization

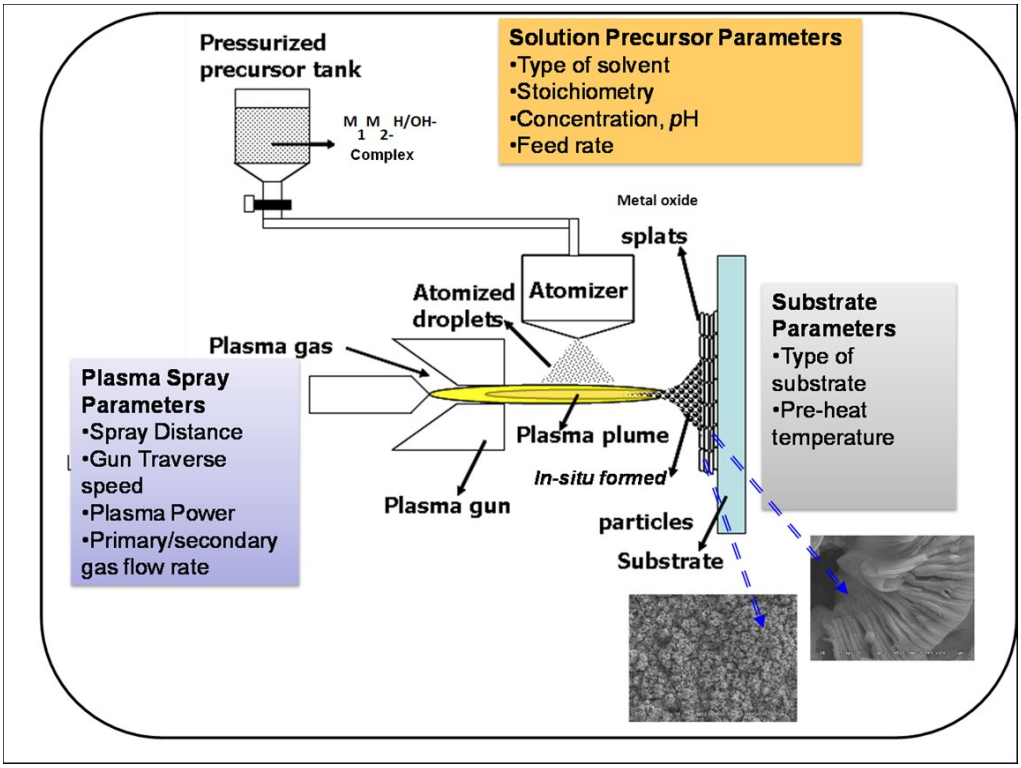

Figure S1. Schematic of the solution precursor plasma spray (SPPS) deposition methodology used for ZnO (SRZO) film deposition

1.2 Morphological studies of various ZnO films

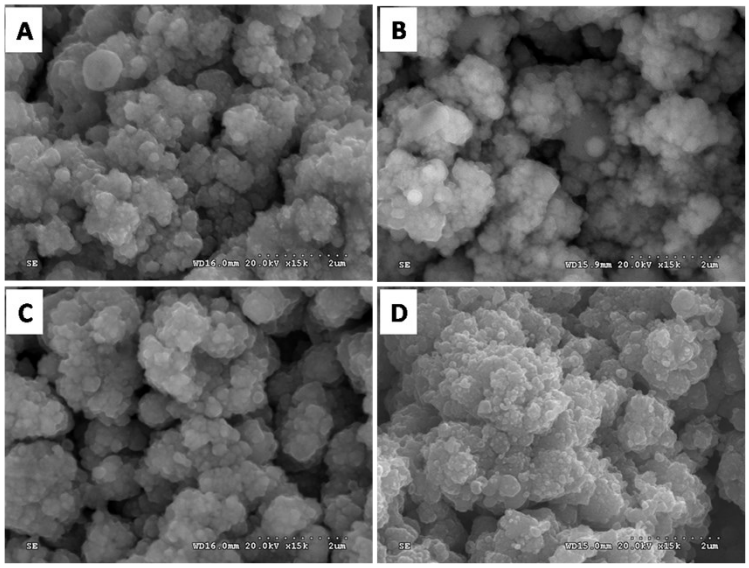

Figure S2. Surface morphology of the ZnO films of different thickness

1.3 Optical absorption studies of various ZnO films

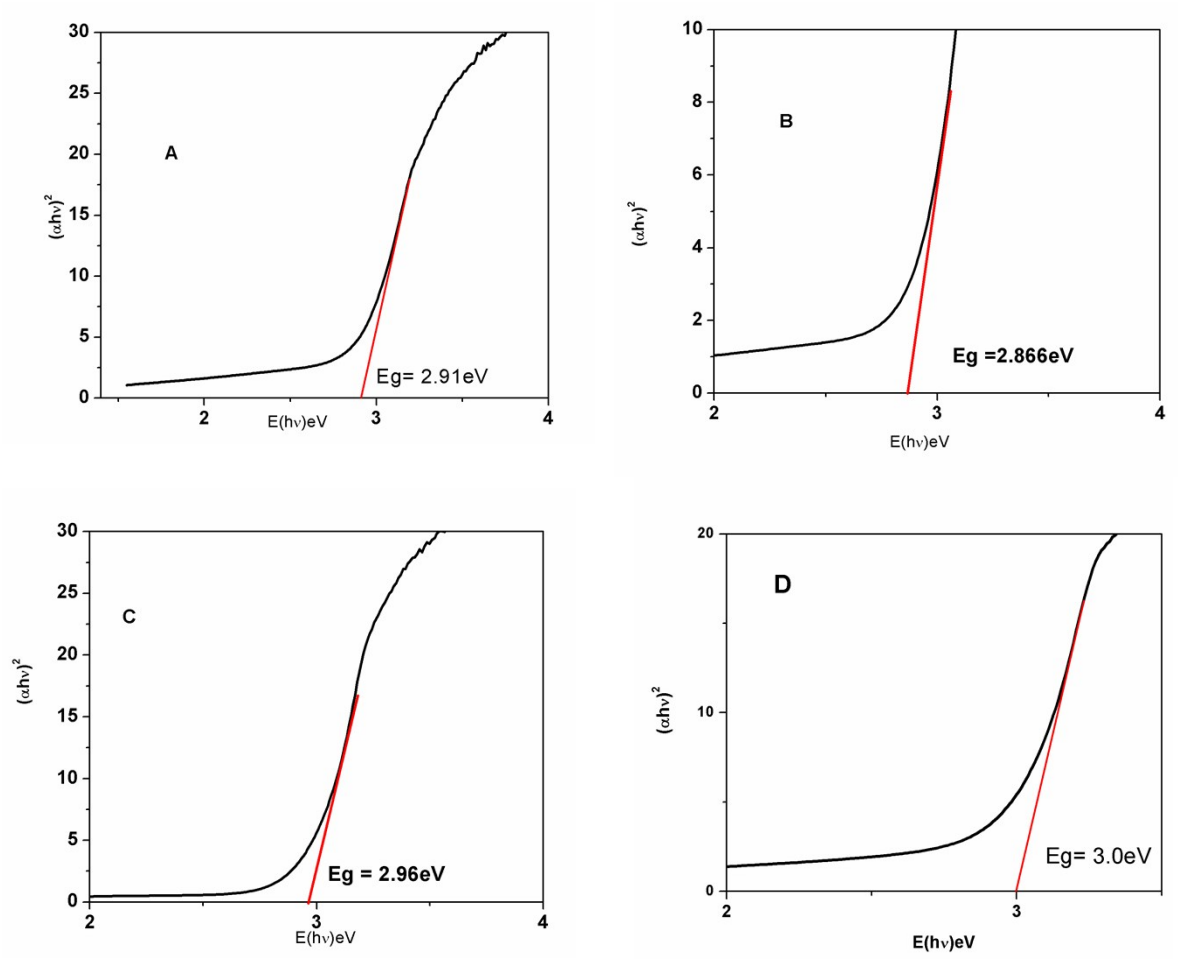

Figure S3. Tauc plots of the individual ZnO films of different thickness obtained from DRS absorption spectra

1.4 Photo Electrochemical characterization

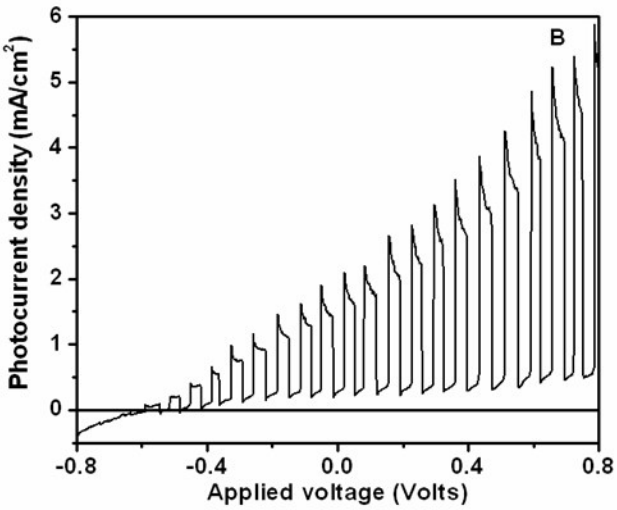

Figure S4. Chron :-potential curves for ZnO filmB under **Hg arc lamp** under light ON/OFF conditions at 0.6V baising

1.5 Incident photon to current conversion efficiency (IPCE)

IPCE is one of the most important characterizations for PEC devices. It describes the photocurrent collected per incident photon flux as a function of illumination wavelength. IPCE was calculated for different electrodes using following equation (3):

$$IPCE = \frac{1240 * J_{ph}}{P * \lambda} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where J_{ph} the photocurrent density in mAcm^{-2}, P is power of source in mWcm^{-2} and λ is wavelength in nm.

1.6 Electrochemical impedance spectroscopy (EIS) studies on the ZnO films

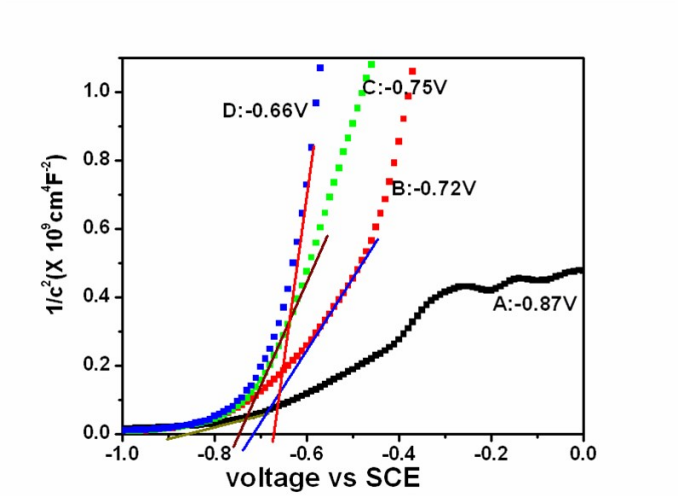

Figure S5. M-S plots of ZnO films of different thickness under dark conditions at zero bias and an ac applied voltage of 10mv and frequency 10kZ.

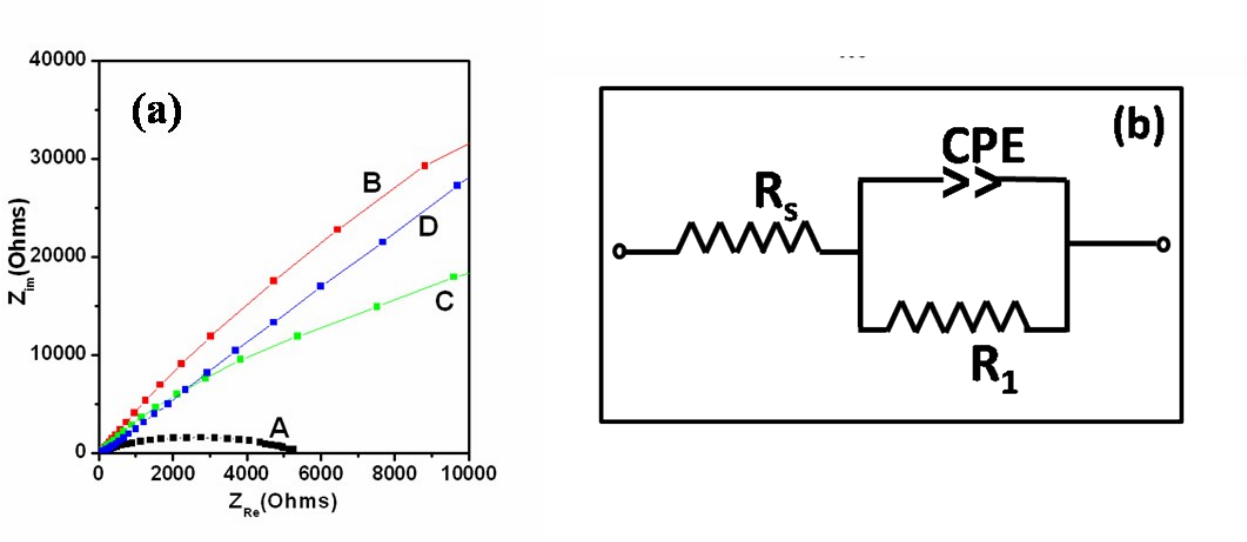

Figure S6.(a)EIS spectra of ZnO films of different thickness (b) Equivalent Randell circuit fitted using Zview software

Table S1. Electrochemical parameters obtained from Randell circuit using Zview software

Electrode	R_s (Ω)	R_1(Ω)	CPE 1-T	CPE 1-P
A	4.9	5762	0.0001114	0.611
B	11.47	174910	0.0001354	0.789
C	29.32	7345000	0.000209	0.771
D	29.7	$7.287X10^{12}$	0.000057	0.710