Supplementary Information

Comprehensive insights into charge dynamics process and excellent photoelectric properties of heterojunction solar cells†

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Supplementary Table

Table SI1. The work functions (Φ) and electron affinities (χ) of graphene, ZTO, CBS, SSM and Pt.

Material	graphene	ZTO	CBS	SSM	Pt
Work function (eV)	4.78	5.24	4.20	4.5	5.65
Electron affinity (eV)	4.78	5.12	4.04	4.5	5.65

Supplementary Figures

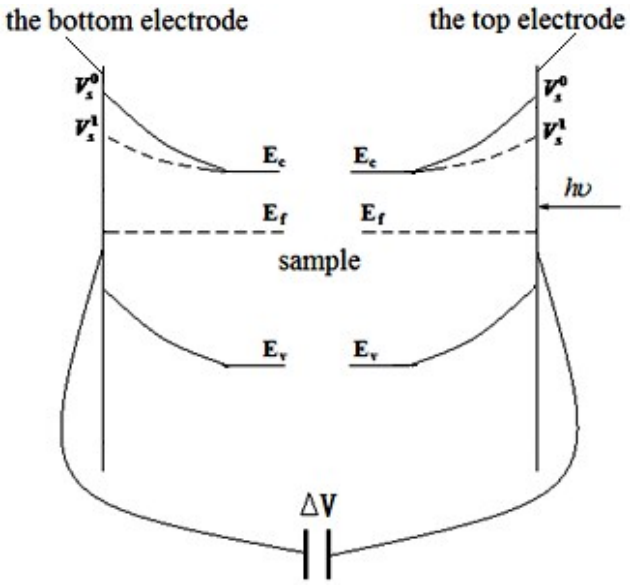

Figure SI1. The schematic diagram of sandwich structure including two electrodes in surface photovoltage spectroscopy (E_c : the bottom of conduction band; E_v : the top of valence band; E_f : the Fermi energy level; ΔV : the difference of different surface potential; V_s^0 : the surface potential before illumination; V_s^1 : the surface potential after illumination; V_s^0 , V_s^1>0; *hυ*: the incident photon energy).

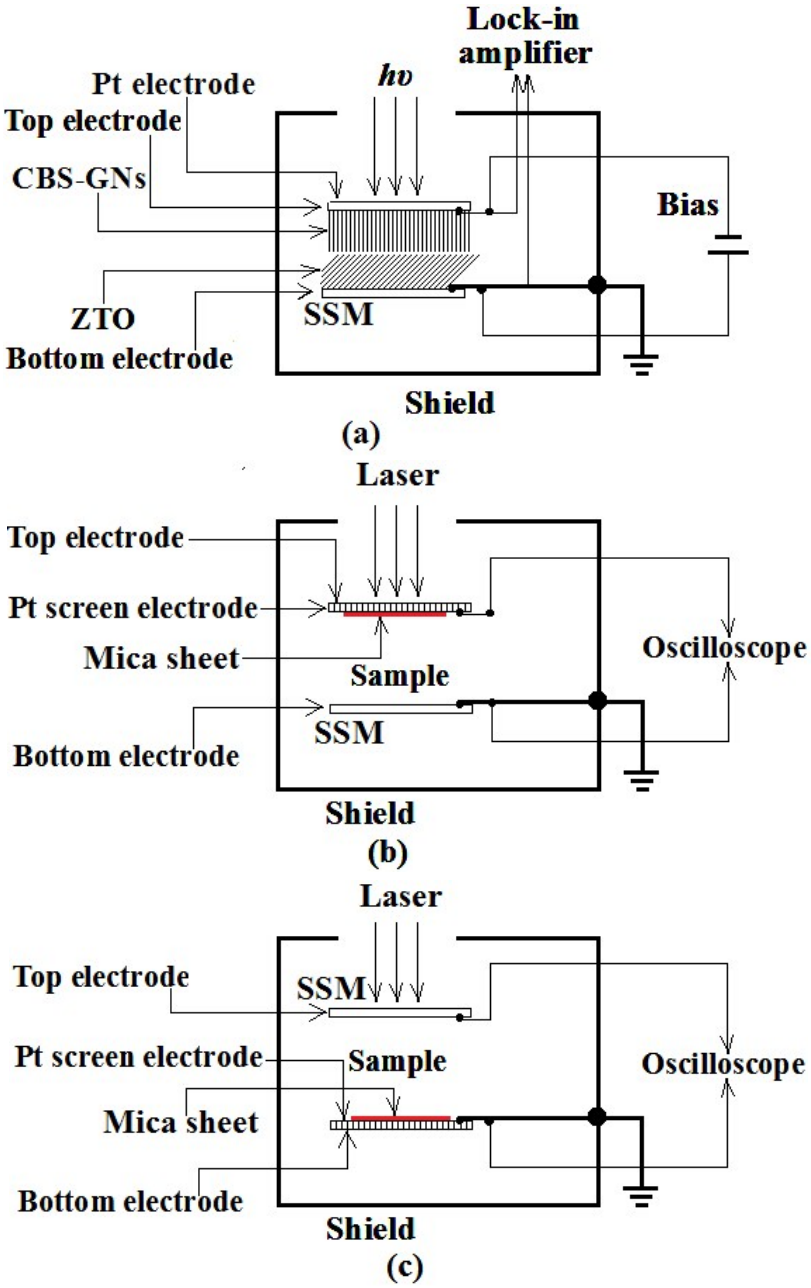

Figure SI2. (a) The schematic diagram of sandwich structure for SPS. (b) and (c) The schematic diagrams of transient surface photovoltage spectroscopy under illumination from bilateral current collectors (*hv*: the incident photon energy).

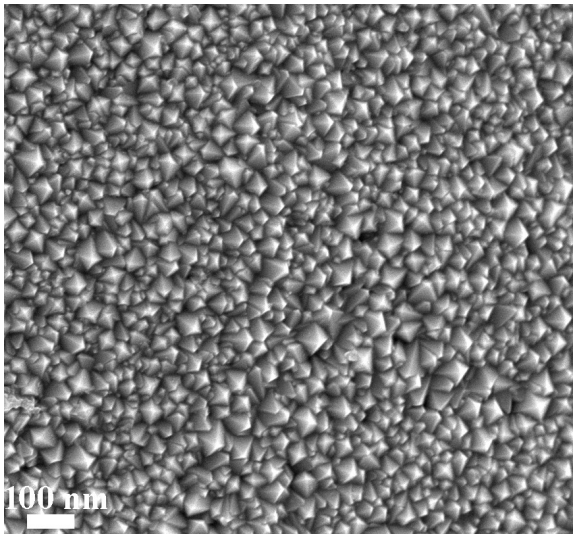

Figure SI3. The SEM image of ZTO octahedron nanoparticles.

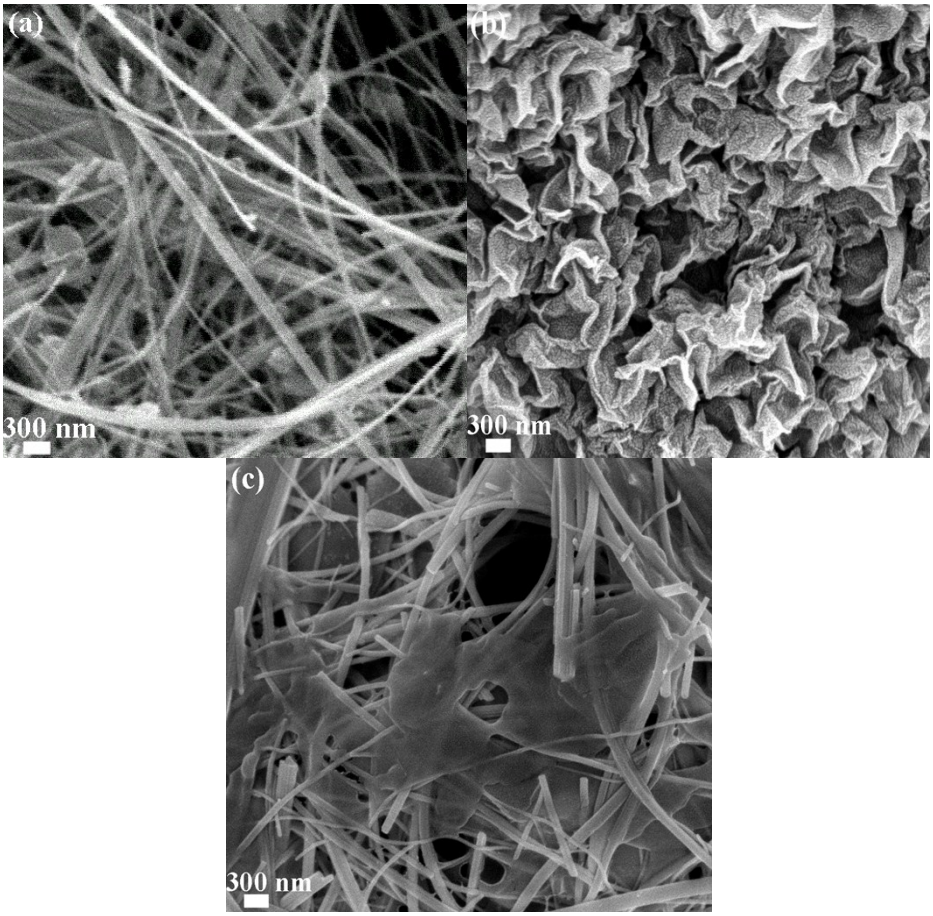

Figure SI4. The SEM images of CBS, GNs and CBS-GNs with the same magnification.

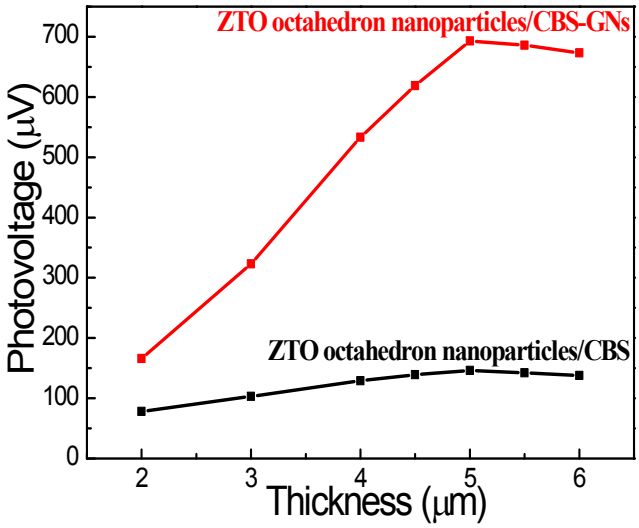

Figure SI5. The relation curves of SPV peaks to film thickness for ZTO/CBS and ZTO/CBS-GNs (GNs: 1.6 wt.%).

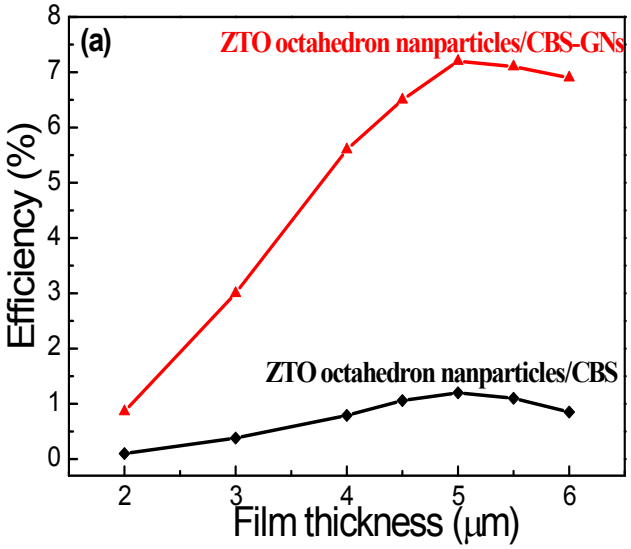

Figure SI6. The overall photoelectric efficiencies of ZTO/CBS and ZTO/CBS-GNs BHJ solar cells with changing CBS-GNs (or CBS) thickness.