

SUPPORTING INFORMATION FOR

PbS as a highly catalytic counter electrode for
polysulfide based quantum dot solar cells

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Similar results were achieved with CdS sensitized electrodes which were prepared as follows:

TiO₂ electrode preparation - EPD

Electrodes for CdS sensitization were prepared by the electrophoretic deposition (EPD)¹ of Degussa P25 particles with an average particle diameter of 25 nm. The particles were deposited through two consecutive cycles of 30 seconds at a constant current density of 0.5 mA/cm², with a drying step at 120 °C for 5 min between each cycle. Following the EPD process, these electrodes were dried in air at 150 °C for 30 min, pressed at 800 kg/cm² using an hydraulic press, and sintered at 550°C for 1 hour. The thickness of the EPD electrodes was 5 microns measured by the profilometer (Surftest SV-500).

CdS QD deposition –

For CdS QDs deposition by CBD method firstly introduced by hodes² The electrodes were immersed in a mixture of 0.5 M CdSO₄ and 0.7 M potassium nitrilotriacetate (K₃NTA) at pH 8.5 adjusted by 10% KOH. This solution was mixed with of 0.4 M thiourea and then diluted with distilled water to a final volume of 100ml. Finally, the pH was readjusted to pH 11 using again 10% KOH. After the electrode was immersed into the solution, it was heated up to 70 °C for two hours, resulting in CdS deposition on the mesoporous TiO₂ electrode.

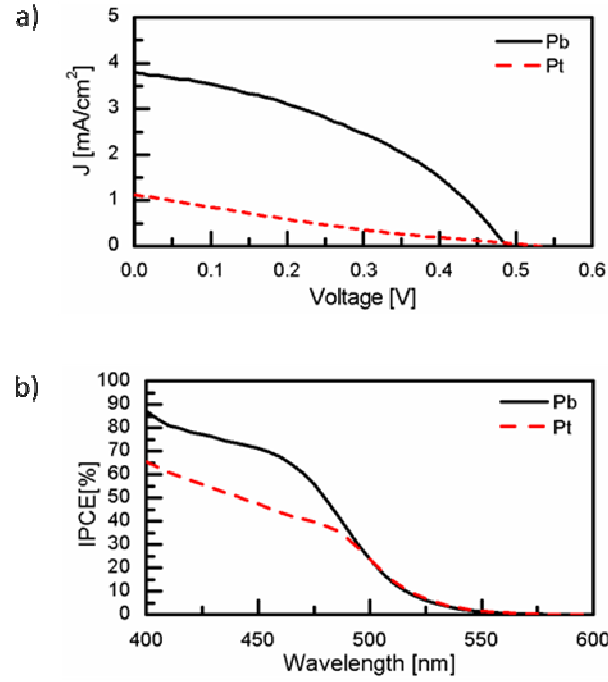


Figure 1: (a) The I-V measurements of CdS quantum dot sensitized solar cell based on PbS and Pt CE's. (b) Incident photon to electron conversion efficiencies (IPCE).

| Counter in use | P(max) | Voc(mV) | Jsc(mA/cm ²) | Fill factor |
|----------------|--------|---------|--------------------------|-------------|
| PbS | 743 | 484 | 3.81 | 40.3 |
| Pt | 119 | 514 | 1.160 | 19.9 |

Table 1: Summarizes the parameters for the I-V scan showing a 6-fold increase of the conversion efficiency ending up with 0.74% which achieved by replacing the Pt-CE to PbS. (Error estimation is approximately 1%)

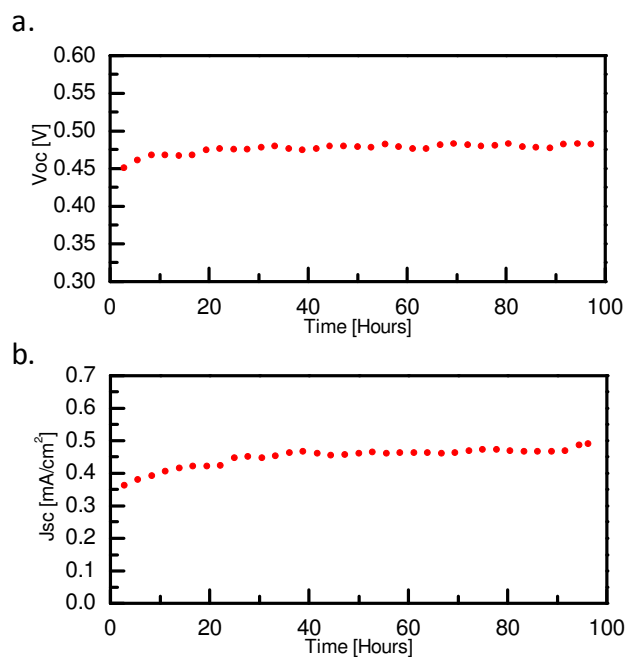


Figure 2: Stability measurements of CdSe sensitized solar cell. (a) V_{oc} vs time measurement. (b) Short circuit current vs time measurement. All measurements were made in a closed Teflon cell under illumination intensity for 100 hours.

References:

- (1) Grinis, L.; Dor, S.; Ofir, A.; Zaban, A. *Journal of Photochemistry and Photobiology a-Chemistry* **2008**, 198, 52.
- (2) Gorer, S.; Hodes, G. *Journal of Physical Chemistry* **1994**, 98, 5338.