Supporting Information

Cost-effective and morphology controllable PVP based highly efficient CuS counter electrodes for high-efficiency quantum dot-sensitized solar cells

Hee-Je Kim, Lee Myung-Sik, Chandu V.V.M. Gopi*, M. Venkata-Haritha, S. Srinivasa Rao, Soo-Kyoung Kim

School of Electrical Engineering, Pusan National University, Gumjeong-Ku, Jangjeong-Dong, Busan 609-735, South Korea

*Corresponding authors. Tel.: +82 51 510 2364; fax: +82 51 513 0212.

E-mail: naga5673@gmail.com

Fabrication of photoanode:

The photoanodes were prepared by the following procedure. TiO_2 paste with a particle size of 20 nm (Ti-Nanoxide HT/TP, Solaronix) was coated by the doctor blade method and sintered at 450 ^oC for 30 min, producing a thickness of 7.5 μm after the solvent evaporation, and an active area of 0.27 cm^2. QDs were synthesized using the successive ionic layer adsorption and reaction (SILAR) process. First, TiO_2 film was alternately dipped into 0.1 M $Cd(NO_3)_2$ and 0.1 M Na_2S solution five times for 5 min in each dipping cycle. Second, the TiO_2/CdS_5 film was dipped into 0.1 M $Cd(NO_3)_2$ and an aqueous Na_2SeSO_3 solution alternately eight times for 2 min in each

dipping. The aqueous solution of Na_2SeSO_3 was prepared by refluxing 0.1 M Se and 0.2 M Na_2SO_3 in an aqueous solution at 120 ^oC for 2 h. Finally, the TiO_2/ CdS_5/$CdSe_8$ electrodes were passivated with ZnS by alternately dipping into 0.1 M $Zn(NO_3)_2$ and 0.1 M Na_2S solution two times for 5 min for each dipping cycle. Finally, the prepared photoanode and counter electrodes were sealed using a sealant (SX 1170-60, Solaronix) at 100 ^oC. The space between the electrodes was filled with polysulfide electrolyte consisting of sodium sulfide (1 M), sulfur (2 M), and sodium hydroxide (0.2 M) in a solution of methanol and water, which were present at a ratio of 7:3.