Highly Efficient Photoelectrochemical Hydrogen Production Using CdS/CdSe Co-sensitized TiO_2 Nanorod Array Photoelectrode

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Increasing the light harvest and improving the charge injection and collection efficiency are main approaches in the research of photon energy conversion devices. In particular, charge collection efficiency is one of the major factors governing the performance of various types of solar energy conversion devices such as photovoltaic and photoelectrochemical (PEC) cells. For that reason, one-dimensional (1D) nanostructured metal oxide photoelectrodes such as nanorods, nanowires and nanotubes has been widely researched because of improvements in charge collection efficiency compared to conventional nanoparticle film photoelectrode. We prepared TiO_2 nanorod array (TNA) photoelectrode coupled with CdS/CdSe co-sensitizer for highly efficient photoelectrochemical hydrogen production and compared to TiO_2 nanoparticle film (TNP) photoelectrode. The single crystalline TiO_2 nanorod array offers efficient charge transport path and CdS/CdSe co-sensitizer is found to have a synergetic effect in the visible light absorption and. The saturated photocurrent achieved by the CdS/CdSe-TNA photoelectrode under the illumination of AM1.5 (100 mW/cm^2) is 12.95mA/cm^2 at 0 V (vs Ag/AgCl), which is twice the value obtained by the CdS/CdSe-TNP photoelectrode.

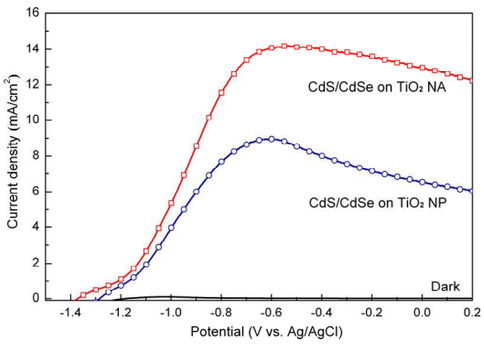

Fig. 1 Current density vs applied potential (*J-V*) curves of CdS/CdSe co-sensitized TNA and TNP photoelectrodes.