

Catalyst-Free Amorphous Silicon-Based Tandem Thin Film Photocathode with High Photovoltage for Solar Water Splitting

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SUPPORTING INFORMATION

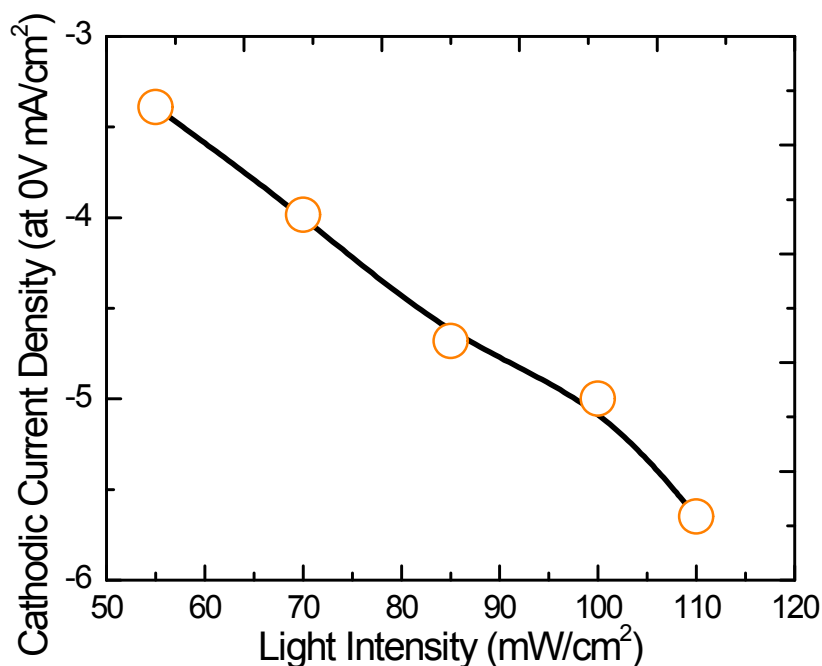


Figure S1. Photocurrent at 0 V vs. RHE as a function of light intensity.

Catalytically active a-MoS₃ catalysts were deposited with a scalable wet chemical synthesis to act as hydrogen evolution catalysts in the proposed a-Si/a-SiGe tandem photocathode. To characterize the PEC catalytic activity of the a-MoS₃ catalysts in an overall water-splitting system, a wired water-splitting device comprising of four μ c-Si:H single-junction solar cells in series was deployed in a three-electrode configuration with a Pt counter

electrode and the immersed catalyst electrodes acting as the working electrodes. The four $\mu\text{c-Si:H}$ single-junction solar cells ($V_{oc}=0.507$ V) in series can provide an enough V_{oc} of 2.2 V for water splitting. A-MoS₃ catalysts were fabricated on a conductive FTO substrate. The J - E characteristics of the FTO supported a-MoS₃ and the referenced bare FTO and Pt electrodes under illumination are presented in Figure S2.

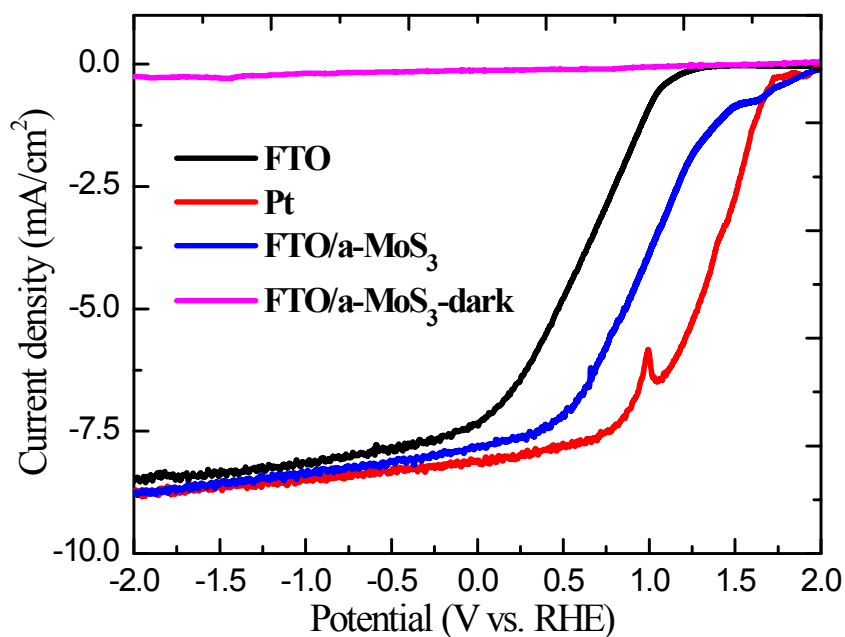


Figure S2. J - E characteristics of the FTO, FTO supported a-MoS₃, and Pt catalysts measured with a serial water-splitting device.

Obviously, the addition of a-MoS₃ catalysts on the FTO substrate can positively shift the onset potential E_{on} from 1.43 V to 2.0 V, indicating that large overpotential losses on the FTO/electrolyte can be partially compensated for. Although the photocurrents at the positive potentials for the FTO supported a-MoS₃ electrode are still lower than that of the Pt electrode, a nearly similar E_{on} value can be achieved for our a-MoS₃ catalysts in comparison to the Pt electrode.

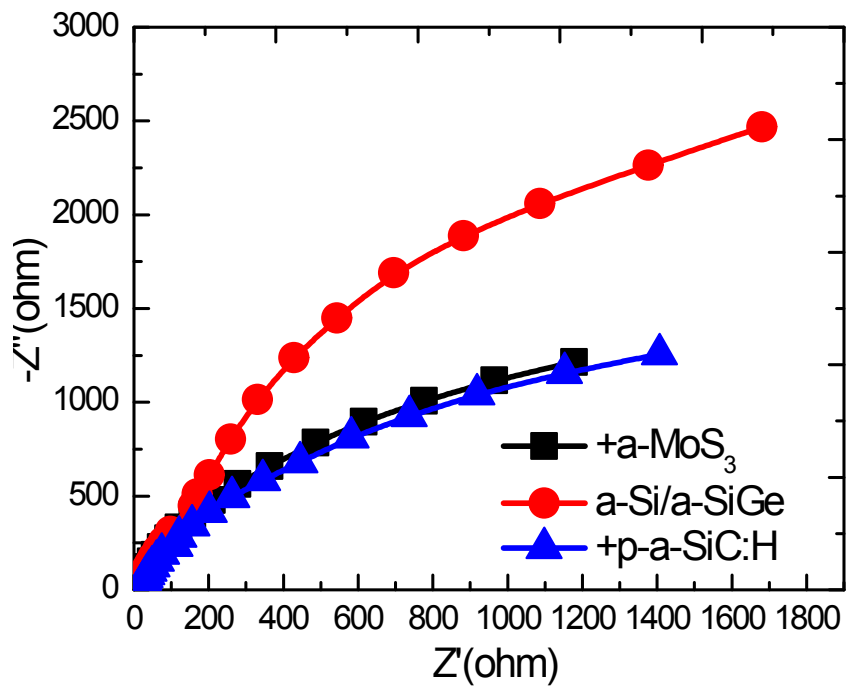


Figure S3. EIS Nyquist plots of unprotected, p-a-SiC:H protected, and a-MoS₃ catalyzed unprotected a-Si/a-Si tandem photocathodes.

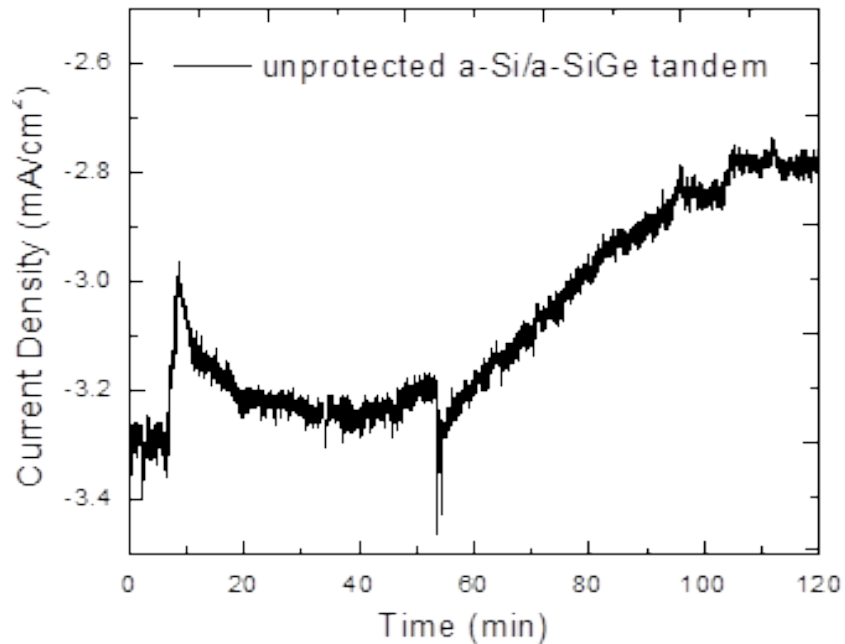


Figure S4. $J-t$ curve of the unprotected a-Si/a-SiGe tandem photocathode measured at 0 V vs. RHE.