Enhancement of the Photocurrent Response of Tungsten Nano-Structures Using an Indium Tin Oxide Coating

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Titanium dioxide is generally considered an efficient metal oxide semiconductor for PEC solar cells. However, it absorbs only 5-7% of the solar spectrum, which is considered poor in terms of photo-conversion efficiency. Another metal oxide semiconductor is tungsten trioxide, which has a higher absorption rate of 12%. In order to measure the plateau-photocurrent density (PPCD) of these two metal oxides, we compared the properties of the tungsten trioxide porous nanostructures with titanium dioxide nanotubes in three electrolytes: Electrolyte A was a solution with NaOH; Electrolyte B was a solution with KOH; and Electrolyte C was a combination of A and B. Ultimately, Electrolyte C produced the highest PPCD for tungsten trioxide, even compared to titanium dioxide. Despite increased absorption with electrolyte C, we found that the surface of tungsten trioxide corrodes faster. In order to reduce this, we used a sputtering technique to coat it with 100 nanometers of indium tin oxide, which reduced the surface corrosion and yielded a 340% increase in photocurrent response. This indicates that a PEC solar cell constructed with tungsten trioxide and indium tin oxide would make the process of producing hydrogen more efficient through enhanced absorption of the solar spectrum.

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