

Effect of intermediate layer in photocurrent improvement of three-layer photoanodes using WO₃ and Fe₂O₃

ABSTRACT

Sol-gel method was applied to synthesize WO₃/Fe₂O₃ three-layer films in order to improve the generated photocurrent under UV-vis light irradiation. The films were deposited on FTO glass substrates through doctor blading method. The samples were then calcined at 500 °C. The photocurrents of the synthesized photoanodes were evaluated by measuring the electric current and voltage under UV-vis light at room temperature. Scanning electron microscopy (SEM) revealed unique surface morphologies owing to the presence of the intermediate layers. At an applied potential of 1300 mV, the WO₃/Fe₂O₃/WO₃ and Fe₂O₃/WO₃/Fe₂O₃ photoanodes exhibited photocurrent densities up to 0.1 mA/cm² and 0.6 mA/cm², respectively. It was found that porous films with easy accessibility to the inner surface reveal high photocurrents. The intermediate layer of WO₃ demonstrated higher values of photocurrent due to roughness enhancement on the upper surface with columnar tree-growth particles. However, a compact state was observed on the cross section of Fe₂O₃ growth. A comparison was also drawn between the two and three-layer photoanodes using Fe₂O₃ and WO₃. The films were characterized by XRD, SEM/EDX, and UV-vis irradiation to determine the photocurrent densities.

Keyword: Photoanode; Multi-layer; Fe₂O₃; WO₃