

Synthesis, characterization and performance evaluation of three-layered photoanodes by introducing a blend of WO₃ and Fe₂O₃ for dye degradation

ABSTRACT

A three-layered photoanode has been synthesized by the introduction of an additional layer of mixed WO₃ and Fe₂O₃. A total of nine differently-packaged films were prepared by sol-gel method. The fabricated photoanodes were then successfully characterized by X-ray diffractometry (XRD), scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX). A comparative study was also done to differentiate the films fabricated with WO₃, Fe₂O₃ and their mixture. Compact, columnar tree and shallow patterns were observed on the cross cleavage of the synthesized layers. These distinct patterns were associated with the growth of layers which consequently led to unique surface morphologies. An increase in photocurrent density was observed on the bicomponent film which has been linked to a high degree of surface roughness as well as improved internal porosity. Three-layered photoanodes, modified with an additional bicomponent layer of WO₃:Fe₂O₃ established much higher photocurrent outputs compared to that of nanostructured WO₃ or Fe₂O₃, regardless of the bicomponent layer arrangement. However, with the bicomponent layer on top and middle, the measured photocurrent soared more than three times as much compared to a slight increase observed when the bicomponent was placed on the bottom.

Keyword: Multi-layered photoanode; Fe₂O₃; WO₃; Bicomponent