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One-step facile preparation of ZnO nanorods as high-performance photoanodes for photoelectrochemical cathodic protection

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ABSTRACT

In this work, ZnO nanorod photoanodes were fabricated by electrodeposition on a conductive indium tin oxide glass substrate, enabling photoelectrochemical cathodic protection (CP) of both stainless and carbon steels in a chloride solution. The surface morphology, composition, crystalline structure and optical absorption property of the prepared ZnO photoanodes were characterized by scanning electron microscopy, energy dispersive X-ray spectrum, X-ray diffraction and UV-Visible diffuse reflection absorption spectrometry, respectively. Electrochemical and photoelectrochemical properties of the photoanodes were measured. Results demonstrate that the ZnO nanorod photoanodes are able to achieve sufficient cathodic polarization to 304 stainless steel and X52 carbon steel in 3.5 wt.% NaCl solution under light illumination. Compared to previously reported ZnO photoanodes, the mass activity of the prepared ZnO nanorod photoanodes in this work is improved nearly 10 times and 3-6 times when coupled with stainless steel and carbon steel, respectively. The unique surface nanostructure of the generated ZnO nanorods contributes to the high photoelectrochemical activity of the

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