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The photoelectrocatalytic activity, long term stability and corrosion performance of NiMo deposited titanium oxide nano-tubes for hydrogen production in alkaline medium

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Graphical Abstract

Highlights

- The electrocatalysis for the hydrogen evolution reaction was investigated.
- For this purpose, titanium was anodized and TiO₂ nano-tubes were produced.
- Nano-structured Ni and Mo doped on TiO₂ nano-tubes (TiO₂/NiMo).
- The TiO₂/NiMo-2 was enhanced electro-catalytic activity and stability.
- Furthermore TiO₂/ NiMo-2 exhibited high corrosion performance in alkaline medium.

Abstract

In this study, titanium oxide nano-tubes are doped with Ni and Mo particles with various chemical compositions, in order to put forth the efficiency of single and binary coatings on hydrogen evolution reaction (HER) in 1 M KOH. The characterization was achieved by cyclic voltammetry, scanning electron microscopy and energy dispersive X-ray analysis. The water wettability characteristics of electrode surfaces were investigated using contact angle. The long-term catalyst stability and corrosion performance were determined by current–potential curves and electrochemical impedance spectroscopy. Furthermore, photoelectrochemical behavior was determined via linear sweep voltammetry. Results showed that, nano-structured Ni and Mo deposited titanium oxide nano-tubes decrease the hydrogen over potential and increase HER efficiency, it is stable over 168 h electrolysis and it exhibits higher corrosion performance.

Keywords: Catalysis; coating materials; corrosion; electrochemical impedance spectroscopy; hydrogen production

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