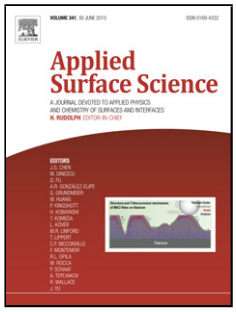

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PII: S0169-4332(17)31536-2
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.05.180
Reference: APSUSC 36115

To appear in: *APSUSC*

Received date: 10-3-2017
Revised date: 10-5-2017
Accepted date: 22-5-2017

Please cite this article as: Evrim Baran, Zeynep Baz, Ramazan Esen, Birgül Yazici Devrim, TiO2-NT electrodes modified with Ag and diamond like carbon (DLC) for hydrogen evolution in alkaline water electrolysis, Applied Surface Sciencehttp://dx.doi.org/10.1016/j.apsusc.2017.05.180

TiO_2-NT electrodes modified with Ag and diamond like carbon (DLC) for hydrogen evolution in alkaline water electrolysis

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Highlights:

- TiO_2 nanotubes electrode was modified with silver and diamond like carbon (DLC).
- The additions of Ag and DLC have in turn a positive impact on mechanical properties of TiO_2-NT film.
- The deposition of silver provides ~14.95 % savings of the energy consumption.
- The electrodes have good electrochemical stability for hydrogen evolution reaction.

Abstract

In present work, the two-step anodization technique was applied for synthesis of TiO_2 nanotube (NT). Silver and diamond like carbon (DLC) were coated on the surface of as prepared TiO_2-NT using chemical reduction method and MW ECR plasma system. The morphology, composition and structure of the electrodes were examined by field emission scanning electron microscopy (FE-SEM), energy dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD). The results showed that Ag nanoparticles, having size in the range of 48-115 nm, are evenly distributed on the top, inside and outside surface of TiO_2-NT and when DLC was coated on the surface of TiO_2-NT and TiO_2-NT-Ag , the top of nanotubes were partially open and the pore diameter of hexagonal structure decreased from 165 nm to of 38-80 nm. On the other hand, the microhardness test and contact angle measurements revealed that additions of Ag and diamond like carbon have a positive effect on the mechanical properties of TiO_2-NT film. The electrocatalytic properties of the electrodes towards the hydrogen evolution reaction (HER) were investigated by the electrochemical measurements recorded in 1 M KOH solution. In addition, long-term durability of electrodes towards HER and the energy consumption of alkaline electrolysis were investigated. The energy requirement showed

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