Electrocatalytic Hydrogen Generation using Sn loaded TiO₂ Nanotubes

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Advanced nanomaterials for electrocatalytic water splitting are crucial to the field of renewable energy. Here, we developed a novel hydrothermal synthesis of tin-titanium oxide nanotubes (Sn-TNTs) selectively on GC electrodes in acidic solution. XRD, SEM, EDX, and Raman spectra characterizations of TNT and doped Sn-TNTs were carried out, suggesting successful incorporation of Sn in the tubular structure of TiO₂. The catalytic activity towards the hydrogen evolution reaction (HER) of TNTs and Sn-TNTs doped with electrodeposited Pd and/or Pt nanoparticles was investigated using CV and Tafel polarization measurements. The activation energy (E_a) and reaction mechanism were determined using Tafel polarization curves. The Sn-TNTs/Pt-Pd-modified catalyst showed greater efficiency and lower E_a (2.78 kJ/mol) for the electrocatalytic production of hydrogen than the Sn-TNTs, where no activity has been shown with TNTs. Adsorption of hydrogen on the catalyst controlled the overall reaction rate. This study opens a new viewpoint for the development of highly active TNT electrocatalysts for hydrogen production from water splitting.

Keywords: titania; hydrothermal synthesis; nanotube; water splitting; energy.

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