Hussein Alrobei et al., J Material Sci Eng 2017, 6:2 (Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.061

α-hematite-molybdenum disulfide and polyhexylthiophene (RRPHTh)-nanodiamond (ND) electrodes for photoelectrochemical applications

Hussein Alrobei and **Manoj K Ram**
University of South Florida, USA

The alpha (α)-hematite (Fe_2O_3) nanomaterial is attractive due to its band gap, chemical robustness, availability in the nature and excellent photoelectrochemical (PEC) properties to split water into oxygen and hydrogen. However, the α-Fe_2O_3 suffers from low conductivity, slow surface kinetic, low carrier diffusion and greater electron-hole combination. The electronic properties such as carrier mobility and diffusion of α-Fe_2O_3 can be improved through doping, synthesis of composite material or formation of structured films. Recently, 2D-molybdenum disulfide (M_oS_2) has shown interesting photocatalytic activity due to its bonding, chemical composition, doping and nanoparticles grown on other 2D-film. Recently, our group has studied photoelectrochemical properties of hybrid film of regioregular poly (3-hexylthiophene-2, 5-diyl) (P3HT) with nanodiamond as well as P3HT-M_oS_2. In the present study, we have studied photoelectrochemical properties of polyhexylthiophene (RRPHTh)-nanodiamond (ND) and α-Fe_2O_3-M_oS_2 nanocomposite based electrodes films. The photoelectrochemical properties of α-Fe_2O_3-M_oS_2 as n-type and ND-RRPHTh as p-type electrodes in photoelectrochemical cell in various electrodes have been studied. We have obtained 3 to 4 times higher photocurrent and energy conversion efficiencies than the parent electrode based photoelectrochemical cell. We have synthesized nanocomposite α-Fe_2O_3-M_oS_2 using sol-gel technique. The nanocomposite α-Fe_2O_3-M_oS_2 as well as ND-RRPHTh films were characterized using SEM, X-ray diffraction, UV-vis, FTIR and Raman techniques. The electrochemical techniques were used to understand the photocurrent in electrode/electrolyte interface of α-Fe_2O_3-M_oS_2 as well as ND-RRPHTh films in both acid base based electrolyte. The α-Fe_2O_3-M_oS_2 and ND-RRPHTh electrodes reveal improved production of hydrogen compared to α-Fe_2O_3 and aluminum doped α-Fe_2O_3 and M_oS_2 doped α-Fe_2O_3 nanostructured films. The band structure has been used to understand the mechanism of photoelectrochemical water splitting in p-n types based photoelectrochemical cell.

Biography

Hussein Saad Alrobei is a PhD candidate at Mechanical Engineering Department,University of South Florida, USA and lecturer at Mechanical Engineering Department, Prince Sattam Bin Abdulaziz University, Saudi Arabia.

alrobei@mail.usf.edu

Notes: