The improved photoelectrochemical properties using α-hematite -molybdenum disulfide nanostructured material

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The alpha (α)-hematite (Fe₂O₃) nanomaterials are attractive due its optical, electrical, and photoelectrochemical (PEC) properties. Several transition metal ions (Ti, Al, Pt, Zn etc.) have been doped to enhance low conductivity, surface kinetic, carrier diffusion, and decreasing of the photocorrosion. However, little attention is paid to dope dichalcogenide 2D-molybdenum disulfide (MoS₂) with α-Fe₂O₃. The MoS₂ has shown interesting photo-activity due to its bonding, chemical composition and doping properties. So, we have synthesized nanocomposite α-Fe₂O₃-MoS₂ using sol-gel technique. The α-Fe₂O₃-MoS₂ nanomaterial was characterized using combination of physical techniques such as SEM, X-ray diffraction, UV-vis, FTIR and Raman techniques, respectively. The photocurrent, electrode/electrolyte interface of α-Fe₂O₃-MoS₂ nanocomposite films were investigated using electrochemical techniques. The rhombohedral structure with lower band gap is obtained using X-ray diffraction and UV-vis measurements for α-Fe₂O₃-MoS₂ films. Besides, α-Fe₂O₃-MoS₂ film revealed improved hydrogen production compared to α-Fe₂O₃ as well as aluminum doped α-Fe₂O₃ nanostructured films. Later, mechanism of photoelectrochemical water splitting in nanocomposite α-Fe₂O₃-MoS₂ films is understood through band diagram.

Biography
Hussein Alrobei is a Ph.D student under the supervision of Manoj K Ram. He has background in the field of photoelectrochemical, advanced materials, polymers and energy. He has been involved on photoelectrochemical properties on various metal oxides, polymers and conducting polymers, and recently his patent on nano-hybrid structured regioregular polyhexylthiophene blend films for production of photoelectrochemical energy has been approved.

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DOI: 10.4172/2321-6212-C1-011