World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:14, No:01, 2020

Structural Alteration of MoS_2 by Incorporating Fe, Co Composite for an Enhanced Oxygen Evolution Reaction

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Abstract : Developing efficient non-noble metal catalysts that are cheap and durable for oxygen evolution reaction (OER) is a great challenge. Moreover, altering the electronic structure of the catalyst and structural engineering of the materials provide a new direction for enhancing the OER. Herein, we have successfully synthesized Fe and Co incorporated MoS_2 catalysts, which show improved catalytic activity for OER when compared with MoS_2, Fe-MoS_2, and Co-MoS_2. It was found that at an optimal ratio of Fe and Co, the electronic and structural modification of MoS_2 occurs, which leads to change in orientation and thereby enhances the active catalytic sites on the edges, which are more exposed for OER. The nanocomposites have been well characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), and energy dispersive X-ray analysis (EDX), Elemental Mapping, transmission electron microscope (TEM), and high-resolution transmission electron microscope (HR-TEM) analysis. Among all, a particular ratio of FeCo-MoS_2 exhibits a much smaller onset with better catalytic current density. The remarkable catalytic activity is mainly attributed to the synergistic effect from the Fe and Co. Most importantly, our work provides an essential insight in altering the electronic structure of MoS_2 based materials by incorporating promoters such as Co and Fe in an optimal amount, which enhances OER activity.

Keywords : electrocatalysts, molybdenum disulfide, oxygen evolution reaction, transition metals
Conference Title : ICNNEM 2020 : International Conference on Nanotechnologies, Nanomaterials and Electronic Materials
Conference Location : Paris, France
Conference Dates : January 23-24, 2020

Open Science Index, Materials and Metallurgical Engineering Vol:14, No:01, 2020 publications.waset.org/abstracts/118638.pdf