Abstract

In the past ten years, research on clean energy technologies such as fuel cells and water splitting has been intense because of their pollution-free nature. Today, the world is moving towards non-platinum group metals (non-PGM) for the synthesis of efficient electrocatalysts for hydrogen production. The production of high-efficiency electrocatalysts without the use of additional energy is therefore highly desirable yet difficult. One of the cleanest and simplest ways to produce high-purity hydrogen and a good way to store extra electrical power is electrolysis, which uses electricity generated intermittently from heat, solar, wind, or waste energy. Different features, such as good catalytic activity, inexpensive, low overpotential for hydrogen evolution reaction (HER), and high stability must be present in efficient electrocatalysts. A constant challenge in this scenario is the development of an inexpensive electrode with exceptional durability and high activity for both the electrolysis of water and HER at a high current density. The sluggish kinetics and stabilities of noble metal-free electrocatalysts provide the main obstacles in the quest for Pt group materials to replace in the hydrogen evolution reaction (HER) while using alkaline electrolytes. The transition metal complexes MX, where X represents selenides (Se), carbides (C), nitrides (N), phosphides (P), sulfides (S) and M represents tungsten (W), cobalt (Co), molybdenum (Mo), and nickel (Ni), appear to be the most feasible choice on the basis of electrochemical stability and electrocatalytic activity. The most promising element with the greatest capacity for amorphization, molybdenum, has been extensively studied in the literature. This research paid particular attention to the induced co-deposition of iron (Fe) and molybdenum (Mo). This study describes the effective fabrication of a novel electrocatalyst made of the earth-abundant transition metals such as iron and molybdenum with a three-dimensional (3D) nanostructure and high activity on Ni foam (NF) substrate using the simple electroless deposition approach via water bath reflux. $NiFe_1Mo_2$/NF exhibited a low overpotential of 190mV at the current density of 10mA/cm^2 for HER and 340mV at the current density of 100mA/cm^2 for OER. This is the efficient bifunctional electrocatalyst for the production of hydrogen and oxygen.