ABSTRACT

Energy demand and utilization are anticipated to quadruple over the next 50 years,along with a considerable increase in energy prices. As the primary energy sourcetoday, petroleum products contribute significantly to the greenhouse gases in theatmosphere and other ecological disasters by putting large amounts of CO_2 into theatmosphere. To address these issues, novel, eco-friendly and sustainable energysources must be developed. Water is a natural resource in this context and is a worthysource to generate hydrogen (H_2) and Oxygen(O_2) in the presence of suitableelectrocatalysts. Currently, platinum group metals (PGMs) function admirably in thecontext of HER along with the minimal possible amount of overpotential, whereasRuO_2 and IrO_2 are two of the finest electrode materials for OER. However, tcommercialize this technology, it is necessary to switch from noble metal-basedelectrode materials to non-noble metallic ones. Therefore, the design and development ofcost-effective and more efficient electrocatalysts are direly needed to make the water splittingprocess practically viable. Chalcogenides centered on transition metals such as nickel(Ni), manganese (Mn), cobalt (Co), iron (Fe), and molybdenum (Mo) demonstratedencouraging activity in HER and OER. Additionally, materials got examined usingseveral physical analysis methods, including SEM and EDS. By using the drop cast and in-situ methods, several Ni_xSe_yB/Ni-foam electrocatalysts were fabricated in this research. The optimal catalyst $Ni_{0.2}Sep_{0.3}B$/Ni-foam only requires a small overpotential of 210 mV to drive 100 mA cm^{-2} for OER. Up to 2 V vs. RHE, a tremendously high current density of 600 mA cm^{-2} was observed. A measurement of the onset potential of the OER activity, which is 1.57V against RHE, was alsoperformed. The very high value of the current density of 600 mA/cm^{-2} confirms theextraordinary catalytic capacity of the OER electrocatalyst system. Moreover, it can afford 10 mA cm^{-2} of current density at an overpotential of 107 mV toward the HER. More importantly, this electrolyzer maintained its electrocatalytic activity even after continual water splitting for 20 h. The advantage is that formulation can be carried out quickly using a simple design in ambient conditions. The above achievements could set the approach for the creation of many more sophisticated composites along with the science of producing energy that has a modifiable structure-property relationship.