

International Conference on

Industrial Chemistry

June 27-28, 2016 New Orleans, Louisiana, USA

Novel Ni alloy-graphene composite electrodes for hydrogen production

D Krishna Bhat

National Institute of Technology Karnataka, India

Hydrogen, a renewable and clean fuel, is considered as a potential energy carrier for future energy infrastructure. The electrocatalytic splitting of water by hydrogen evolution reaction (HER) is an important process with high energy conversion efficiency for hydrogen production. Active, stable and cost-effective electrocatalysts are a key to water splitting for hydrogen production through electrolysis. Herein, we report the facile preparation of highly porous Ni alloy-Graphene composite electrode by embedding graphene into the Ni alloy matrix via room temperature electrodeposition for electrocatalytic applications such as water splitting. The incorporation of graphene into Ni alloy matrix enhances the catalyst's activity for HER in alkaline solution. The best coating exhibits a maximum current density of -850 mA cm^{-2} at -1.6 V , which is approximately 4 times better than that of binary Ni alloys indicating higher activity for hydrogen production. Addition of graphene to electrolyte bath results in porous encapsulated bundle of alloy nano-particles within the graphene network which effectively increases the electrochemically active surface area. As indicated by XPS analysis results, on addition of graphene metal content in the deposit increases and as a result both cobalt/cobalt oxide and nickel/nickel oxide sites are evenly distributed on Ni alloy-Graphene composite electrode surface which is responsible for increased HER activity. The Tafel slope analysis showed that the HER follows Volmer-Tafel mechanism. The structure-property relationship of Co-Ni-G composite coating has been discussed by interpreting field emission scanning electron microscopy (FESEM), X-ray photoelectron spectroscopy (XPS) and X-ray diffraction (XRD) analysis results.

denthajekb@gmail.com

The tooelite story

Arindam Malakar

University of Nebraska, USA

Arsenic, which is very toxic for human health, has many oxidation states and can exist in both inorganic and organic form. Mainly, inorganic Arsenic in (III) and (V) oxidation state are present groundwater. The maximum contamination level (MCL) of Arsenic present in drinkable water is set to $10 \mu\text{g/L}$ or 10 ppb by World Health Organization (WHO). As(III), called Arsenite is bound with three (OH)-atoms forming arsenous acid (H^3AsO_3 or $\text{As}(\text{OH})_3$) in circumneutral pH. As(V), called Arsenate is bound to four O-atom, is generally represented as $\text{AsO}(\text{OH})_3$ or H_3AsO_4 but in circumneutral pH it generally exist in -1 or -2 charged as $\text{H}_2\text{AsO}_4^{1-}$ or HAsO_4^{2-} forms. As per present techniques, removal efficiency of As(III) from natural contaminated groundwater without prior oxidation to As(V) is very low due to its neutrality at circumneutral pH. The problem is underground water of Bengal basin or most of the part of world has rather high amount of As(III) (as high as 67% to 99% of total As-content) than As(V). In case of Bengal basin As(III) content is as high as 80%. Tooeelite is a natural As(III)-bearing mineral discovered in the U.S. Mine Tooele Country, Utah in the year 1992. It is only arsenite-sulphur containing mineral in world. It has high Fe:As ratio (1.2) which was termed as a ready source for permanent remediation of As(III) in nature. Removal of arsenite from natural underground water in form of tooeelite is not feasible till date, as precipitation of tooeelite crystals demands quite low pH \sim 3 (which is nowhere near pH \sim 7 of groundwater) and may take \sim 30 days. In here it will be shown how As(III) present in natural contaminated water is arrested in tooeelite-like crystal at circumneutral pH, within 3 hrs of treatment using specialized nanostructures.

ari1201@gmail.com