HYDROGEN GENERATION ON CoFe CoFeMn AND CoFeMo COATINGS DEPOSITED ON Ni FOAM VIA ELCTEROLESS METAL PLATING

Huma Amber[1], Karina Vjunova[1,2], Zita Sukackiene[1], Dijana Šimkūnaitė[1], Jurate Vaiciuniene[1], Loreta Tamasauskaite-Tamasiunaite[1], Eugenijus Norkus[1]

[1]Department of Catalysis, Center for Physical Sciences and Technology (FTMC), Vilnius, Lithuania
[2]Faculty of Chemistry and Geosciences, Vilnius University, Vilnius, Lithuania
huma.amber@ftmc.lt

Hydrogen has emerged as one of the most promising future energy carriers in recent years, owing to concerns over the depletion of fossil fuel supplies, environmental pollution, and global warming attributable to the greenhouse effect caused by a steep increase in carbon dioxide and other gases. However, highly efficient hydrogen production is a critical issue. Borohydrides have received much attention as potential hydrogen storage materials due to their high hydrogen capacities. Among borohydrides, sodium borohydride ($NaBH_4$) is recognized as an ideal candidate for hydrogen storage and generation due to its multi-advantages, such as its non-flammability, high stability in alkaline solution, low-cost, non-toxic nature, easy handling, availability and a large H_2 storage capacity (10.9 wt%).

In this study, the catalytic hydrogen generation was evaluated on the cobalt-iron (CoFe), cobalt-iron-manganese (CoFeMn), and cobalt-iron-molybdenum (CoFeMo) coatings deposited on the Ni foam substrate using the electroless metal plating method and morpholine borane as the reducing agent. The characterization of the surface morphology, structure, and composition of resulted coatings was done using scanning electron microscopy (SEM) and inductively coupled plasma optical emission spectroscopy (ICP-OES). The catalytic activity of the prepared CoFe/Ni, CoFeMn/Ni, and CoFeMo/Ni catalysts was investigated for hydrogen generation from an alkaline $NaBH_4$ solution at different temperatures. It was found that the hydrogen generation rate of ca. 5.2, 7.8, and 11.7 L min^{-1} g^{-1} was achieved by using the CoFe/Ni, CoFeMo/Ni, and CoFeMn/Ni coatings, respectively, at 343 K. Among the investigated catalysts, CoFeMn/Ni exhibits the lowest activation energy of 62.4 kJ mol^{-1} and the highest hydrogen generation rate of 11.7 L min^{-1} g^{-1} at 343 K.