Hydrogen generation from the catalytic hydrolysis of sodium borohydride using nanostructured Pt-Ni, Pt-Cu and Pt-Co catalysts supported on the titanium surface

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Sodium borohydride is an attractive alternative fuel for application in fuel cells as alternative hydrogen sources (indirect borohydride fuel cells (IDBFC)) due to its advantages of high hydrogen storage efficiency (10.8 wt.%), stability in air at high pH values, easily controlled generation of hydrogen and high purity of hydrogen obtained from the catalytic hydrolysis of sodium borohydride solution, nonflammability and side product recyclability [1,2]. Active search of effective catalysts for catalytic hydrolysis of sodium borohydride solution to generate pure hydrogen is still in progress.

Here we present the study of nanostructured Pt-Ni, Pt-Cu and Pt-Co catalysts deposited on the titanium surface for the catalytic hydrolysis of sodium borohydride. The nanostructured catalysts with different Pt loadings were deposited on the titanium surface via galvanic displacement technique. Thin electroless films of Ni, Cu and Co were chosen as underlayers for the formation of immersion platinum overlayer onto the titanium surface. The morphology and composition of prepared catalysts were characterized using field-emission scanning electron microscopy and energy dispersive X-ray spectroscopy. The catalytic activity of nanostructured Pt(Ni)/Ti, Pt(Cu)/Ti and Pt(Co)/Ti catalysts was determined by measuring the amount of hydrogen generated directly from aqueous alkaline solutions of sodium borohydride. The data on hydrogen generation volume with respect to time at different concentrations of sodium borohydride and different temperatures have been presented.

It was found that the nanostructured Pt(Ni)/Ti, Pt(Cu)/Ti and Pt(Co)/Ti catalysts exhibit a higher catalytic activity for the hydrolysis of sodium borohydride as compared with those of Ni/Ti, Cu/Ti and Co/Ti catalysts.

References

[1] S. C. Amendola, S. L. Sharp-Goldman, M. S. Janjua, N. C. Spencer, M. T. Kelly, P. J. Petillo, M. Binder, Int. J. Hydrogen Energy 25 (2000) 969.
[2] S. C. Amendola, S. L. Sharp-Goldman, M. S. Janjua, M. T. Kelly, P. J. Petillo, M. Binder, J. Power Sources 85 (2000) 186.