

CATALYST DEPOSITION ON LARGE ELECTRODES IN MEMBRANE ALKALINE WATER ELECTROLYSIS

Denk K.¹, Ľuba M.², Hnát J.¹, Žitka J.³, Paidar M.¹, Bouzek K.¹

¹*Department of Inorganic Technology, University of Chemistry and Technology, Prague, Czech Republic*

²*Department of Chemistry, Faculty of Agriculture and Forestry, University of Warmia and Mazury, Olsztyn, Poland*

³*Institute of Macromolecular Chemistry, Czech Academy of Sciences, Praha, Czech Republic.*

In the last years, the world is shifting towards more ecological power production. One of the promising energy carriers is hydrogen. Alkaline water electrolysis is the most developed technology of water electrolysis for hydrogen production. It is still of interest for researchers finding ways of further improvement of this technology. One of the major steps is incorporation of anion-selective membranes instead of porous diaphragms, this step allows for reduced temperature and concentration of the liquid electrolyte to be used. Together with the cell separators, the electrode catalysts which are not based on platinum-group metals are being developed. The deposition of the catalysts on large-area electrodes is often disregarded.

This work is focused on preparation of nickel-based mixed-metal oxides catalysts in form of a coating on nickel-foam electrodes with area of 78.5 cm². The metals selected for the catalyst synthesis were nickel with cobalt for anode, and nickel with iron for cathode. The precursors were precipitated in form of hydroxide or oxohydroxide by means of cathodic alkaline precipitation on the surface of the nickel foam. The electrodes with the deposited precursors were annealed at 325 °C for 4 hours which lead to the formation of mixed-metal oxides.

The prepared electrodes were tested in a single-cell membrane alkaline water electrolyser. Solution of 1 mol dm⁻³ KOH was used as the liquid electrolyte. The catalysts showed higher activity for water electrolysis than bare nickel foam. The electrodes also showed better stability at constant-current testing which lasted for 16 hours. The method of cathodic precipitation was shown as viable for preparation of large-area electrodes with catalysts.

Acknowledgment:

This work was supported from the grant of Specific university research – grant No. A2_FCHT_2022_001. Financial support by the Technology agency of the Czech Republic within the framework of the project No. TK02030103 is gratefully acknowledged.