MODEL OF ALKALINE WATER ELECTROLYSIS IN CONNECTION WITH RENEWABLE SOURCES OF ENERGY

Denk K., Paidar M., Hnát J., Bouzek K.

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

Current electrical energy production is shifting towards renewable sources of energy instead of utilizing fossil fuels. Renewable sources of energy usually produce the electricity according to actual meteorological conditions and time of the day. Unstable power production, which is not in synchronization with the actual consumption, requires energy storage.

The abundant electricity can be stored in form of an energy carrier – hydrogen gas which can be produced by water electrolysis. This hydrogen can be added to natural gas, utilized in chemical industry, turned into electricity in fuel-cells, or as fuel in vehicles such as personal cars, buses or trains.

Water electrolysis and renewable sources of energy combination requires proper assessment prior to realization. Simple mathematical model was created to estimate performance and dynamics of an alkaline water electrolyser in relation with an unstable source of energy. The model electrolyser has several settings in both construction (number of cells, area of one cell, and others) which influences the rated power of the electrolyser, and operating conditions (minimum and maximum operating temperature, minimal power load, heating, cooling). An existing photovoltaic power plant and excess electricity from regenerative braking of trains were selected as the unstable power source. Given the power source or their combination, optimal power rating of an electrolyser can be assessed. Thus, this model is a valuable tool for research of possible hydrogen production as it can be used to predict optimal size of the electrolyser for the intended power source.

Acknowledgment:
This work was supported from the grant of Specific university research – grant No. A2_FCHT_2022_001. This project is financed by the Technology Agency of the Czech Republic under grant TO01000324, in the frame of the KAPPA programme, with funding from EEA Grants and Norway Grants.