Designing of lab-scaled system for green hydrogen production based on AEM water electrolysis

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The current situation related to climate change and the goals of decarbonization by 2050, as well as the increase in fossil fuel prices significantly affects the increase in demand for clean and sustainable energy sources. The green hydrogen appears as one of the possible substitutes for fossil fuels, and has great potential in the fight against climate change. It is most often produced by electrolysis of water using electricity from renewable energy sources. The two main conventional technologies are alkaline electrolysis (AE) and proton-exchange membrane (PEM). AE is often ineffective due to the problem of fouling deposit formation on electrocatalysts, so it is not suitable for the production of large amounts of hydrogen. PEM is effective, but very expensive due to the use of complex structure membranes and noble metal electrocatalysts. Recently, research has been made related to anion-exchange membrane (AEM) electrolysis, which offers advantages such as the use of non-noble metal electrocatalysts and simplicity of design. The goal is to enable inexpensive production of large amounts of hydrogen.

In our work designing of the lab-scaled AEM water electrolysis system is presented. Modulation of DC power source signal was performed using pulse-width modulation (PWM) technique. Combining the width of the square-shaped formed signal, frequency and other operating parameters, optimal conditions for maximum hydrogen production were accomplished. Using of AEM electrolysis and PWM technique significant efficiency was achieved in the production of green hydrogen based on AEM water electrolysis technology.

Key words: lab-scaled system, green hydrogen, AEM water electrolysis, PWM technique