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HYDROGEN PRODUCTION BY ALKALINE ELECTROLYSIS INTEGRATED WITH GREEN TECHNOLOGIES

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Introduction

Green processes refer to reducing carbon footprint while burning conventional fuels by integrating the renewable energy sources. Industrial decarbonization is the most important stage in preventing climate change and reducing the environmental pollution with greenhouse gases. The end of the year 2021 was marked by an important decision the European Commission that accepted Romania's National Recovery and Resilience Plan that suggests "developing a favorable legislative and regulatory framework for future technologies, involving the use of green hydrogen and developing optimal storage methods".

To make a transition to a green economy based on renewable energy sources implying hydrogen as an energy vector, new technologies must be provided to obtain it at a competitive price compared to the hydrogen obtained from classical methods (such as steam methane reforming). Also, the current applications of hydrogen in the field of transport using conventional fuels require the development of optimal methods of its use.

Results and conclusions

In this study, the methods of obtaining hydrogen through alkaline electrolysis and the possibilities of developing hydrogen through chemistry or for obtaining electricity are presented comparatively.

Hydrogen generation by alkaline water electrolysis and proton exchange membrane electrolysis, or by ultrapure brine electrolysis in chlor-alkali membrane cells are mature technologies on the market, and are the most promising due to their low temperature operation. The comparative analysis of hydrogen generation processes by alkaline electrolysis of water or ultrapure brine highlighted the advantages and disadvantages of the two processes. The main indicators that must be analyzed are: the voltage of the electrolysis cell, the current density, the operating time of the membranes, the specific energy consumption, the cost of the process.

Progress in the field of green hydrogen production by ultrapure brine electrolysis pathways will be determined in the future by the efficiency of the alkaline

electrolysis processes and by the operating parameters of the electrolysis cells equipped with an ion exchange membrane. The industrial process of brine electrolysis, that generates hydrogen, along with chlorine and sodium hydroxide is a viable process for industrial decarbonization. This is explained by the multitude of ways to exploit the three resulting products. Moreover, it is possible harnessing energy and chemistry of hydrogen obtaining new green products with a reduced carbon footprint (Figure 1). Also, integrating hydrogen in a loop of electric energy generating by hydrogen fuel cells is important.

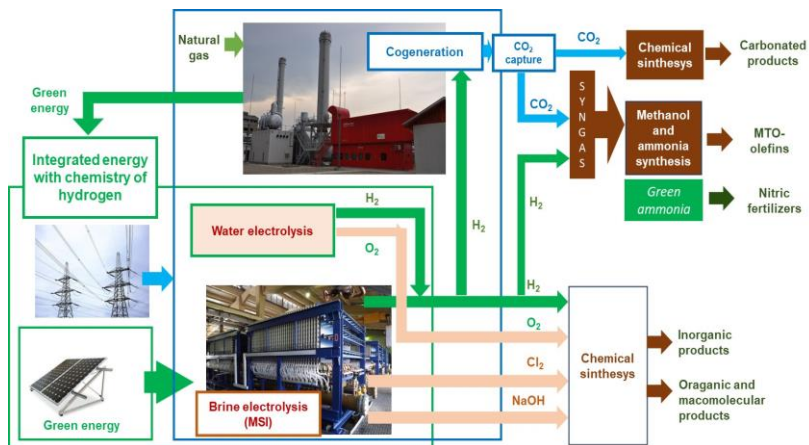


Figure 1. Integrated use of energy and chemistry of hydrogen for industrial decarbonization

The lack of carbon footprint when applying the electrochemical processes justifies the inclusion of hydrogen in the category of green hydrogen, for which the cost price of electricity and final product – hydrogen, is important. From this perspective, the electricity demand may be compensated by partial or total use of renewable energy sources, or by hydrogen generated from electrolysis.

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