Fabrication, Characterization and Testing of Alkaline Electrolyzers for hydrogen production

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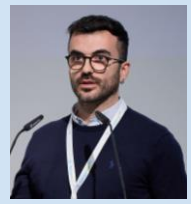

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Alkalyne electrolyzers

In recent years, renewable energy sources have become more and more relevant owing to the progressive decarbonization of energy processes to reduce CO_2 emissions.
In this context, the interest in green hydrogen has drastically increased. One way to produce green hydrogen is water electrolysis using only electricity from renewable sources. It is a viable strategy to take advantage of the surplus electricity from renewable sources and overcome their unpredictability which is the main drawback.
The most relevant part of the cost of electrochemical hydrogen comes from the electrocatalysts. For this reason, research is focused on improving the performance of electrolyzers, using more efficient and less expensive materials, such as transition metal alloys like Nickel-based alloy.
To further improve the performance of electrocatalysts the development of nanostructured electrodes, characterized by low cost and high electrocatalytic activity, was also proposed.

The proposed technique for the fabrication of the nanostructured electrodes is known as template electrosynthesis. The template used is a commercial porous polycarbonate membrane, which thanks to its morphology allows the formation of nanowire-shaped nanostructures. This type of nanostructured electrode has the advantage of possessing a high surface area. Template electrosynthesis consists is a three-step process:

1) Gold sputtering (necessary to make conductive a surface of the template).
2) Electrodeposition of current collector (a compact nickel layer, also necessary to ensure adequate mechanical strength to the electrode).
3) Electrodeposition of the nanowires inside the template pores.

Electrodes are characterized by many physical-chemical techniques and electrochemically tested to study their performance. These electrodes are used to assemble alkaline electrolyzers in different configurations.

The main goal of this research is the design and development of an alkaline electrolyzer with nanostructured electrodes of Nikel based alloy.