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Study of a new electrode design for water electrolysis

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Abstract

Statement of the Problem: The energy transition has already begun and in it, hydrogen plays an important role, since it would allow renewable energy to be stored without emissions of carbon dioxide and other greenhouse gases. One way to obtain green hydrogen is through the electrolysis of water using renewable energy sources. This is a process identified with great potential for decarbonization, but it must increase its efficiency, lower the price of its components and, consequently, the price of production in order to expand its manufacture and use. In order to improve the performance of alkaline electrolyzers, this work has focused on evaluating a new electrode design. This design contemplates a series of wavy channels and flat ribs between them. Methodology & Theoretical Orientation: The electrode evaluation cell is assembled and the electrodes are connected directly to the power supply. The experiment is initiated when the initial working temperature is 20 °C. The potential difference varies from 0.1 [V] every 30 seconds along a voltage applied difference from 0 to 2.7 [V]. The stainless-steel electrodes have been evaluated at different distances to determine which of them presents the best performance. The distances between electrodes are: 7.70, 6.08 ,5.53 and 4,97 mm. Findings: Figure 1 shows the polarization curves of the distances analyzed. The standard error for each point, is plotted. It can be seen that as the distance is decreased, the current density increases. Conclusion & Significance: For the proposed electrode design, comparing the longest and the closest distance, the percentage of increase in the current density is approximately 40%. The study of this type of geometry should be continued to evaluate whether it produces an improvement in bubble detachment if the curvature of the channels is modified.

Biography

Maria Jose Lavorante is Science Bachelor in Chemistry. Director of Research and Development Division of Renewable Energy at the Institution of Scientific and Technological Research for Defense (CITEDEF), Villa Martelli, Buenos Aires Province, Argentina. Her research interests include alkaline water electrolyzers, PEM fuel cells and conductometric titrations. She is Head Professor at the Engineer Faculty of the Army Div. Grl. Manuel Nicolás Savio, in charge of the subjects Organic Chemistry, Organic Synthesis and Solids and Colloidal Chemistry. Maria Jose Lavorante is a member of the Argentina Chemistry Association.