INFLUENCE OF THE CATALYST PARTICLES SIZE AND CRYSTALLINE PHASE ON ELECTROCATALYTICAL PERFORMANCE OF $Co_{0.83}Ni_{0.17}Se_2$ FOR OXYGEN REDUCTION REACTION IN ALKALINE FUEL CELL

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Oxygen reduction reaction (ORR) represents a key electrode half-reaction in an alkaline fuel cell, due to slow kinetics caused by complicated electron transfer. To address this issue, ORR must be catalyzed. In commercial alkaline fuel cells, platinum catalysts are usually used because platinum exhibits high electrocatalytic activity for the ORR. However, the price of Pt catalyst increases the capital expenses. In an alkaline environment, numerous materials are thermodynamically stable and ORR active catalysts are available at a lower cost. According to the literature, the selenide-based catalysts exhibited a promising activity for the oxygen reduction reaction.

This study aims to prepare $Co_{0.83}Ni_{0.17}Se_2$ catalysts and verify the influence of the particle size and crystalline phase on their physical and electrochemical properties.

Amorphous $Co_{0.83}Ni_{0.17}Se_2$ was prepared by the solvothermal synthesis at 100°C. Different particle sizes were achieved by milling the catalyst for 5, 10 and 20 minutes. The crystalline phase was obtained by heating the catalyst to 430 °C. The physico-chemical properties of the catalysts were characterized by SEM-EDS, XRD and electrochemical impedance spectroscopy (EIS). The electrochemical properties were verified by linear sweep voltammetry and EIS on rotating disc electrode in 0.1 mol dm^{-3} KOH at 30 °C. Using Tafel and Koutecky-Levich equations, kinetic parameters such as Tafel slope and exchange current density were determined. Koutecky-Levich analysis also provided information on the reaction mechanism. Based on the results obtained, particles size and crystallinity influence the catalytic activity of the $Co_{0.83}Ni_{0.17}Se_2$.

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