EFFECT OF CARBON SUPPORT ON THE PERFORMANCE OF Pt-BASED ANODES FOR BIO-ALCOHOL FUEL CELLS

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ABSTRACT

Bioalcohols, derived from biomass, play a pivotal role in achieving the goals outlined in the Sustainable Development Scenario (SDS), addressing energy access, curbing air pollution, and mitigating climate change [1]. Fuel cells, utilizing hydrogen and bioalcohols, offer eco-friendly and efficient electricity generation through electrochemical reactions, with applications spanning transportation, portable power, and stationary generation. Challenges arise during the electrooxidation of bioalcohols, presenting issues like catalyst poisoning and degradation due to intermediate compounds such as carbon monoxide[2]. Despite these obstacles, integrating bioalcohols as fuel sources for fuel cells presents an opportunity to tackle environmental concerns and enhance energy efficiency, marking a significant stride towards a low carbon economy that reduces emissions and fosters environmental sustainability.

In the pursuit of optimizing Direct bio-Alcohol Fuel Cells (DbAFCS), this study focuses on leveraging cost-effective materials to enhance the viability of bioalcohols without necessitating additional cleaning processes. The investigation centers around Pt-based catalysts modified with Ru and Sn (bimetallic and trimetallic), deposited on two different supports: the conventional Vulcan and the more innovative graphene nanoplatelets (GNPs), employing the wet impregnation method. GNPs, characterized by their low production costs, high conductivity, and superior specific surface area, emerge as an attractive support that can replace or provide comparable, if not better, performance [3].

Physicochemical methods, including X-ray Diffraction, Transmission Electron Microscopy, BET Surface Area Analysis, and Thermogravimetric Analysis are employed to elucidate the structural and compositional properties of the prepared catalysts. Electrochemical methods, such as Cyclic Voltammetry and Chronoamperometry, provide insights into the electrocatalytic activity, stability, and kinetics. Comparison with conventional catalysts like Vulcan under electrochemical bioalcohol oxidation highlights the potential of GNPs as a support with comparable or even superior electrocatalytic activity and stability for DbAFCS. The interaction between carbon support and metal particles plays a crucial role, with weak interaction in amorphous carbon supports like Vulcan leading to low corrosion resistance and heightened poisoning sensitivity. Conversely, strong support-metal interactions on high crystallinity carbon supports, such as GNPs, enhance catalytic properties, reinforcing poisoning resistance. This research aims to optimize DbAFCS and contribute to a broader understanding of catalyst design in sustainable energy technologies.

KEYWORDS: alcohol fuel cells, Pt-based catalysts, graphene support

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