(Ar, O, N – ions) permits to create semi-amorphous surface structure with increased electrochemical stability and electrochemical activity in some cases.

SDWS2011.0325 Perspectives on the Design and Use of Direct Alcohol Fuel Cells Fed by Alcohol Blends

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Abstract

The fast-growing power demand by portable electronic devices has promoted the increase of global production of portable PEM fuel cell, a quarter of them consist of direct methanol fuel cell (DMFC) units. These present the advantage of being fuelled directly with a liquid fuel, as well as direct ethanol fuel cells (DEFC) do.

Ethanol has much lower toxicity and from an ecological viewpoint ethanol is exceptional among all other types of fuel as it is the only chemical fuel in renewable supply, so direct ethanol fuel cells (DEFC) have also been investigated, despite their lower efficiency due to its poor oxidation kinetics. Ethanol also implies a lower incidence of "crossover" phenomenon. A direct alcohol fuel cell (DAFC) fed with a mixture of both alcohols will probably satisfy both interests: performance and low toxicity.

In this work a preliminary study of a DAFC fed with methanol-ethanol mixtures is presented. The objective of this study is to evaluate the fuel-fuel cell ensemble behaviour and find the main experimental problems that arise when using alcohol blends in different proportions to feed a direct alcohol fuel cell. Evident disadvantages come from the catalyst, whose optimization should be an important goal. Skipping it, a singular DMFC has been built, activated and then fed by a series of methanol-ethanol mixtures with different relative alcohol proportion. After being operated with alcohol mixtures, the cell has been repeatedly operated with methanol solutions in order to check the cell performance recovery.

To evaluate the contribution of the experimental variables, a simple model to obtain the polarization and power curves of an ideal "flexible fuel" direct alcohol fuel cell has been used. The contribution of each fuel to the fuel cell performance is weighted attending to their relative proportion. Methanol oxidation kinetics has been affected by the ethanol presence and the cleaning process reverts only partially this performance loss. A promising research field is open and attention to diverse aspects of direct alcohol fuel cells is required.