

Evaluating the Performance of Passive Direct Methanol Fuel Cell under Varying Operating and Structural Conditions

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Abstract : More recently, a focus has been given to replacing machined stainless steel metal flow fields with inexpensive wire mesh current collectors. The flow fields are based on simple woven wire mesh screens of various stainless steels, which are sandwiched between a thin metal plate of the same material to create a bipolar plate/flow field configuration for use in a stack. Major advantages of using stainless steel wire screens include the elimination of expensive raw materials as well as machining and/or other special fabrication costs. The objective of the project is to improve the performance of the passive direct methanol fuel cell without increasing the cost of the cell and to make it as compact and light as possible. From the literature survey, it was found that very little is done in this direction, and the following methodology was used. 1. The passive direct methanol fuel cell (DMFC) can be made more compact, lighter, and less costly by changing the material used in its construction. 2. Controlling the fuel diffusion rate through the cell improves the performance of the cell. A passive liquid feed direct methanol fuel cell (DMFC) was fabricated using a given MEA (Membrane Electrode Assembly) and tested for different current collector structures. Mesh current collectors of different mesh densities along with different support structures, were used, and the performance was found to be better. Methanol concentration was also varied. Optimisation of mesh size, support structure, and fuel concentration was achieved. Cost analysis was also performed hereby. From the performance analysis study of DMFC, we can conclude with the following points: Area specific resistance (ASR) of wire mesh current collectors is lower than the ASR of stainless steel current collectors. Also, the power produced by wire mesh current collectors is always more than that produced by stainless steel current collectors. 1. Low or moderate methanol concentrations should be used for better and stable DMFC performance. 2. Wiremesh is a good substitute for stainless steel for current collector plates of passive DMFC because of its lower cost (by about 27 %), flexibility, and light in weight characteristics of wire mesh.

Keywords : direct methanol fuel cell, membrane electrode assembly, mesh, mesh size, methanol concentration, support structure

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