摘要

本研究為觀察直接甲醇燃料電池之陰極流道水排除。由於甲醇燃料電池反應後在陰極產生大量的水蒸氣，並凝結成液態水，使空氣無法進入氣體擴散層，陰極產生淹水的現象，更進一步減少反應面積。為了改善淹水的現象，設計具毛細力(流道間距為 500μm)平行流道貼附於陰極氣體擴散層上，流道後端則連接毛細金屬網以收集凝結水，在陰極空氣之對流力的協助下，能順利移除凝結水。

雙極板採用不鏽鋼製作，將所有流道打穿，保留流道壁並覆蓋親水性玻璃，以觀察液態水的移除過程。此陰極流道具有排水、集電、固定 MEA 的功能。為更增加雙極板的導電性與親水性，則在不鏽鋼表面上鍍金。在甲醇濃 2M、流率 2ml/min，空氣流率 80ml/min 下(stoichimetric ratios , λ=4)，可達到 15mW/cm^2，並且流道亦能保持暢通。

關鍵字：水排除、毛細力、雙極板

ABSTRACT

This study observes the water removal process for the cathode-side of a DMFC. During the operation of a DMFC, a large amount of water vapor appears on the surface of GDL and partially condenses into water droplets. Excessive water at the cathode can cause flooding, which hinders oxygen access to the reaction sites and leads to reduced cell performance. To prevent flooding, the flow flied plate adopted capillary parallel channels with their rear ends attached with capillary metal wire mesh for water collection. Assisted by air convection, the capillary force pumped out the condensed water effectively.

For visualization, through parallel channels with cross-sectional dimensions of 500*1000μm were fabricated on the stainless-steel bipolar plate (BP). The surface of flow field plate was coated with gold to further increase the electrical conductivity and hydrophilicity. Through a hydrophilic glass plate covering the BP, the process of water condensation and subsequent removal can be observed. When the air flow rate was 80ml/min (stoichimetric ratios, λ=4), the power output reaches 15 mW/cm2, with the channels free from clogging.

Keywords: water removal、capillary force、bipolar