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## **NUMERICAL STUDIES ON WATER MANAGEMENT IN PEMFC SYSTEM WITH SERPENTINE CHANNEL DESIGN**

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**ABSTRACT:** Serpentine channel is one of the widely implemented flow field designs for polymer electrolyte membrane fuel cell (PEMFC) system. Its design has a better performance in removing water. To date, water management is a critical issue that affects the cell performance. An appropriate water management can avoid cell from channel flooding and membrane dehydrating, two extreme conditions in PEMFC operation. Numerous investigations have been conducting on that design concerning its dimension, shape, and configuration and for various operating conditions. Numerical studies were performed to examine the influence of operation parameters to water distribution and/or water behavior in the membrane and along the channel. This paper aims to present the numerical studies review on water management in PEMFC system when serpentine channel is applied.

**Keywords:** Serpentine; PEMFC; numerical studies; water management

**STUDY EFFECT OF STRESS IN THE ELECTRICAL CONTACT  
RESISTANCE OF BIPOLAR PLATE AND MEMBRANE ELECTRODE  
ASSEMBLY IN PROTON EXCHANGE MEMBRANE FUEL CELL: A  
REVIEW**

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**ABSTRACT:** Stress applying in the stack of Proton Exchange Membrane Fuel Cell (PEMFC) effects the performance of PEMFC. High pressure in the Membrane Electrode Assembly (MEA) can reduce electrical contact resistance between bipolar plate and MEA. Nevertheless, too high pressure in the PEMFC can destroy MEA. Performance of PEMFC can be optimized by make proportional stress in the assembly of PEMFC. Finite element analysis (FEA) is one of method that can be used for analysis of stress in the PEMFC stack. However, setting of parameter in the analysis using FEA still became one of problem if realistic result must be desired. This paper reports setting of parameters in the stress analysis of PEMFC assembly using FEA method and study relationship of stress analysis with electrical contact resistance.

**Keywords:** PEMFC stack; electrical contact resistance; finite element analysis; stress analysis; membrane electrode assembly.

## **PENELAPAN HIDROGEN MELALUI MEMBRAN KOMPOSI PTFE-NAFION**

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**ABSTRAK:** Pada kajian ini dilakukan pengamatan penelapan gas hidrogen pada membran komposit PTFE-Nafion. Membran komposit dibina dengan kaedah pelapisan dengan menggunakan alat penyalut gelek. Pelapisan dilakukan pada penyokong seramik yang berbentuk tiub dengan bahan PTFE dan Nafion. Ujikaji dijalankan dengan membandingkan faktor pemisahan hidrogen terhadap gas N<sub>2</sub> dan CO pada membran komposit PTFE-Nafion. Dari hasil ujikaji didapati fluk penelapan gas hidrogen mencapai 43 cm<sup>3</sup>/cm<sup>2</sup> minit manakala faktor pemisahan hidrogen terhadap N<sub>2</sub> adalah 3.2 dan terhadap CO adalah 2.7. Faktor pemisahan H<sub>2</sub> semakin meningkat bersamaan dengan kenaikan suhu dan menurun dengan kenaikan beda tekanan antara bahagian buangan dan telapan. Keadaan ini menunjukkan penelapan gas pada membran mengikuti kaedah difusi knudsen. Dilihat dari faktor pemisahan dan berlakunya difusi knudsen, maka dapat disimpulkan membran ini boleh digunakan untuk memisahkan gas H<sub>2</sub> dari gas N<sub>2</sub> dan CO.

**Kata Kunci:** kebolehtelapan; permeability; selektiviti; polimer

**REVIEW: DESIGN MODELS OF POLYMER ELECTROLYTE MEMBRANE  
FUEL CELL SYSTEM (PEMFC)**

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**ABSTRACT:** One important aspect to develop fuel cell design is to use the concept of computational models. Mathematical modeling can be used to help research complex, estimates the optimal performance of fuel cells stack, compare several different processes, save costs and time in the investigation. This paper focuses on several reviews of research models used to develop the system design of the Proton Exchange Membrane Fuel Cell (PEMFC). This study was to determine the factors that affect system performance include: stack of PEMFC system, water management system and supply of reactants to the PEMFC stack.

**Keywords:** models; stack PEMFC; system; design; PEM fuel cell