

**EFFECT OF UV IRRADIATION TIME ON PROPERTIES  
SPEEK-MC MEMBRANE**

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## ABSTRACT

This project focusing on Polymer Electrolyte Membrane Fuel Cells (PEMFCs). Sulfonated Poly Ether Ether ketone (SPEEK) was used to replace Nafion as a membrane. Due to drawback of SPEEK, hybrid membranes of SPEEK-MC mixing of SPEEK with Methyl Cellulose using fixed composition was proposed and have been prepared. Then, SPEEK-MC hybrid membrane have been crosslinking using UV irradiation under different time from 0 minutes until 240 minutes. The membrane have been characterized with  $^1\text{H-NMR}$ , ionic conductivity, water uptake and FTIR. The degree of sulfonation of SPEEK is 68%. The ionic conductivity at different UV irradiation time has been studied on the membranes and the results showed that the ionic conductivity was decreased with decreasing of UV irradiation time. The introduction of methoxide group in the base polymer membrane helping in increasing water uptake while crosslinking SPEEK and MC. The highest percentage of water uptake capability at 50 minutes irradiation time. From the characterization of water uptake capability showed that the percentage of water uptake increases at suitable irradiation time.

# CHAPTER 1

## INTRODUCTION

### 1.0 Background of Study

Fuel cell is the electrochemical devices which convert chemical directly that stored in fuels such as hydrogen to electricity (Di Noto, Piga,2012). There are five types of fuel cells that received major effort of research such as solid oxide fuel cells(SOFCs), alkaline fuel cells(AFCs), phosphoric acid fuel cells (PAFCs), molten carbonate fuel cells (MCFCs) and polymer electrolyte membrane(PEM) fuel cells or PEMFCs. Among them PEMFCs has the best potential option for electrical power due to their high energy efficiency and environmental friendly and highly promising alternative for future energy needs. It was constructed using polymer electrolyte membranes(notably Nafion) (Wang, Chen,2011). However, there are crucial drawbacks supplementary with the use of Nafion like poor performance at elevated temperature and high cost which hinder its mass commercialization (Gupta and Choudhary,2011).

Due to drawback of Nafion, Poly ether ether ketone(PEEK) was selected as it is thermostable polymer consisting of non-fluorinated aromatic chains that can be converted to SPEEK due to its excellent thermal, mechanical, chemical properties and low cost the effort (Gupta and Choudhary,2011). However, in order to achieve sufficient proton conductivity, the sulfonated aromatic polymer membranes should possess a high sulfonation level. The increasing incorporation of more number of ( $-SO_3H$ ) group in poly-ether ether ketone (PEEK) during sulfonation level of the membranes leads to overfull swelling in water, as well as high methanol crossover (Han, Zhang,2011).

Due to drawback of SPEEK, effort to cross-linking SPEEK with methyl cellulose (MC) using different technique are proposed to overcome these problem.