

**SULFONATED POLY(2,6-DIMETHYL-1,4-PHENYLENE OXIDE)
COMPOSITE MEMBRANE FILLED BY ZEOLITE
FOR DIRECT METHANOL FUEL CELL**

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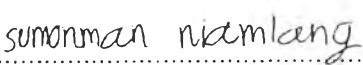

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ABSTRACT

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Keywords: Sulfonated poly(2,6-dimethyl-1,4-phenylene oxide)/ Composite membrane/ Direct methanol fuel cell/ Proton conductivity/ Methanol permeability

Composite membranes were fabricated as a proton exchange membrane (PEM) for direct methanol fuel cell (DMFC). Sulfonated poly(2,6-dimethyl-1,4-phenylene oxide) (SPPO) membrane was prepared by solvent casting. SPPO was subsequently mixed with various contents of zeolite Y to fabricate the composite membranes. The properties of the pristine and composite membranes were characterized by Fourier Transform Infrared spectroscopy (FTIR), Thermogravimetry analysis (TGA), LCR meter, and Gas Chromatography (GC) techniques. The effects of degree of sulfonation and zeolite Y contents were systematically varied to tailor the PEM properties (proton conductivity, methanol permeability, membrane selectivity) in DMFC application. A SPPO/zeolite Y composite membrane at 31% degree of sulfonation with 0.1 %v/v of zeolite Y filling exhibits the highest membrane selectivity, defined as the ratio of proton conductivity to methanol permeability, of 6.02×10^4 S.s/cm³, which is 1.43 times higher than the membrane selectivity of Nafion 117 which is 4.20×10^4 S.s/cm³.

บทคัดย่อ

ปิยะณัฐ โคตะพันธุ์ : การเตรียมและศึกษาเชื้อเลือกผ่านชนิดซัลโฟเนตพอลิฟีนอลิฟีนอลีน ออกไซด์ผสมด้วยซีโอไลต์สำหรับเซลล์เชื้อเพลิงที่ใช้เมทานอล (Sulfonated Poly(2,6-Dimethyl-1,4-Phenylene Oxide) Composite Membrane Filled by Zeolite for Direct Methanol Fuel Cell) อ. ที่ปรึกษา : ศ. ดร. อนุวัฒน์ ศิริวัฒน์ และ Prof. Johannes Schwank 99 หน้า

คอมพอสิตเมมเบรนได้ถูกนำมาใช้เป็นเมมเบรนแลกเปลี่ยนโปรตอนสำหรับนำไปใช้งานในเซลล์เชื้อเพลิงชนิดเมทานอลโดยตรง งานวิจัยนี้ได้ทำการสังเคราะห์ซัลโฟเนตพอลิ(2,6-ไดเมทิล-1,4-ฟีนอลิฟีน ออกไซด์) และนำมาทำการขึ้นรูปเป็นแผ่นฟิล์มโดยวิธีการหล่อฟิล์มด้วยเทคนิคการใช้ตัวทำละลาย หลังจากนั้นซัลโฟเนตพอลิ(2,6-ไดเมทิล-1,4-ฟีนอลิฟีน ออกไซด์) ถูกนำไปผสมกับซีโอไลต์วายเป็นเตรียมเป็นคอมพอสิตเมมเบรนที่ทำหน้าที่แลกเปลี่ยนโปรตอน คุณสมบัติของเมมเบรนและคอมพอสิตเมมเบรนได้ทำการตรวจสอบจากเครื่อง FTIR, TGA, LCR และ GC ผลของปริมาณหมู่ซัลโฟนิคแอซิดที่เข้าไปติดที่สายโซ่พอลิเมอร์ต่อ I หน่วยซ้ำของพอลิ(2,6-ไดเมทิล-1,4-ฟีนอลิฟีน ออกไซด์) และปริมาณของซีโอไลต์วายเป็นได้ถูกตรวจสอบคุณสมบัติที่สำคัญสำหรับเมมเบรนแลกเปลี่ยนโปรตอนดังนี้ เช่น การนำโปรตอน, ความสามารถในการแพร่ของเมทานอล, ความจำเพาะเจาะจงของเมมเบรน เป็นต้น สำหรับเซลล์เชื้อเพลิงชนิดเมทานอลโดยตรง คอมพอสิตเมมเบรนระหว่างพอลิ(2,6-ไดเมทิล-1,4-ฟีนอลิฟีน ออกไซด์) และซีโอไลต์วายเป็นที่ 31 คีกรีโอพซัลโฟเนชันกับ 0.1 เปอร์เซ็นต์โดยปริมาตรของซีโอไลต์วายเป็นแสดงค่าความจำเพาะเจาะจงของเมมเบรนสูงสุด ซึ่งค่าความจำเพาะเจาะจงของเมมเบรนคือ อัตราส่วนระหว่างการนำโปรตอนและความสามารถในการแพร่ของเมทานอลซึ่งมีค่าเท่ากับ 6.02×10^4 ซีเมนต์วินาทีต่อลูกบาศก์เซนติเมตร และมีค่าสูงกว่าค่าความจำเพาะเจาะจงของเมมเบรนของ Nafion 117 ถึง 1.43 เท่า ซึ่งค่าความจำเพาะเจาะจงของเมมเบรนของ Nafion 117 มีค่าเท่ากับ 4.20×10^4 ซีเมนต์วินาทีต่อลูกบาศก์เซนติเมตร

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