

**ENHANCEMENT OF ELECTRICAL CONDUCTIVITY OF PEDOT/PSS BY  
ETHYLENE GLYCOL TREATMENT FOR ACTUATOR APPLICATION**

Wijitra Wichiansee

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**By:** Wijitra Wichiansee  
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Prof. Alexander M. Jamieson

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*Nantaya Yanumet*  
..... College Director  
(Assoc. Prof. Nantaya Yanumet)

**Thesis Committee:**

*Anuvat Sirivat*  
.....  
(Assoc. Prof. Anuvat Sirivat)

*Alexander M. Jamieson*  
.....  
(Prof. Alexander M. Jamieson)

*Sujitra Wongkasemjit*  
.....  
(Assoc. Prof. Sujitra Wongkasemjit)

*Pitt Supaphol*  
.....  
(Assoc. Prof. Pitt Supaphol)

**ABSTRACT**

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The conductivity of a poly(ethylene dioxythiophene)/poly(styrene sulfonate) (PEDOT/PSS) was enhanced by more than an order of magnitude by treating the PEDOT/PSS with an organic solvent, ethylene glycol (EG). PEDOT/PSS was synthesized via a chemical oxidative polymerization (ca. 27 S/cm) and secondly doped with EG to improve its conductivity (>500 S/cm). In this work, we are interested in development of a conductive polymeric gel through PEDOT/PSS and PEDOT/PSS/EG to be blended with poly(dimethylsiloxane) (PDMS) as a substitute for artificial muscles. Electrorheological properties of PDMS\_PEDOT/PSS and PDMS\_PEDOT/PSS/EG blends were investigated under the oscillatory shear mode and with applied electric field strength varying from 0 to 2 kV/mm. Effects of particle conductivity and particle concentration under various electric field strengths were investigated.

## บทคัดย่อ

นางสาววิจิตร วิเชียรศรี : การเพิ่มค่าความนำไฟฟ้าของพอลิเมอร์ผสมระหว่างพอลิเอทิลีนไดออกซีไธอเฟนและพอลิสไตรีนซัลโฟเนทด้วยเอทิลีนไกลคอลเพื่อประยุกต์ใช้เป็นตัวตอบสนองการกระตุ้นทางไฟฟ้า (Enhancement of Electrical Conductivity of PEDOT/PSS by Ethylene Glycol Treatment for Actuator Application) อ. ที่ปรึกษา: รศ.ดร. อนุวัฒน์ ศิริวัฒน์ และ ศ.ดร. อเล็กซานเดอร์ เอ็ม เจมิชอัน 129 หน้า ISBN 974-9990-09-9

การปรับปรุงค่าการนำไฟฟ้าของพอลิเมอร์ผสมระหว่างพอลิเอทิลีนไดออกซีไธอเฟนและพอลิสไตรีนซัลโฟเนทโดยการผสมกับตัวทำละลายอินทรีย์เอทิลีนไกลคอลทำให้ค่าความนำไฟฟ้าเพิ่มขึ้นมากกว่า 2 เท่า โดยพอลิเมอร์ผสมระหว่างพอลิเอทิลีนไดออกซีไธอเฟนและพอลิสไตรีนซัลโฟเนทสังเคราะห์โดยวิธีพอลิเมอร์ไรเซชันแบบออกซิเดชันทางเคมี (~27 ซีเมนต่อเซนติเมตร) แล้วปรับปรุงค่าความนำไฟฟ้าโดยการเพิ่มค่าความนำไฟฟ้าอีกครั้งด้วยเอทิลีนไกลคอลเพื่อปรับปรุงค่าความนำไฟฟ้า (>500 ซีเมนต่อเซนติเมตร) ในงานวิจัยนี้สนใจที่จะศึกษาเพื่อพัฒนาพอลิเมอร์นำไฟฟ้าของพอลิเมอร์ผสมระหว่างพอลิเอทิลีนไดออกซีไธอเฟนและพอลิสไตรีนซัลโฟเนทและพอลิเมอร์ผสมระหว่างพอลิเอทิลีนไดออกซีไธอเฟนและพอลิสไตรีนซัลโฟเนทที่เพิ่มค่าความนำไฟฟ้าอีกครั้งด้วยเอทิลีนไกลคอลซึ่งอยู่ในรูปเจล โดยการเตรียมเป็นพอลิเมอร์ผสมกับพอลิไคเมทิลไซลอคเซนเพื่อประยุกต์ใช้เป็นกล้ามเนื้อเทียม โดยทำการศึกษาสมบัติการไหลของวัตถุที่ตอบสนองทางไฟฟ้าของพอลิเมอร์ผสมระหว่างพอลิเอทิลีนไดออกซีไธอเฟน, พอลิสไตรีนซัลโฟเนทและพอลิไคเมทิลไซลอคเซน และ พอลิเมอร์ผสมระหว่างพอลิไคเมทิลไซลอคเซนและพอลิเอทิลีนไดออกซีไธอเฟน, พอลิสไตรีนซัลโฟเนทที่เพิ่มค่าความนำไฟฟ้าอีกครั้งด้วยเอทิลีนไกลคอลภายใต้การทดลองโดยให้แรงเสียดแบบกลับไปกลับมาและให้สนามไฟฟ้าตั้งแต่ 0 ถึง 2 กิโลโวลต์ต่อมิลลิเมตรกับสารตัวอย่างทั้งพอลิไคเมทิลไซลอคเซนบริสุทธิ์และพอลิเมอร์ผสม นอกจากนี้ยังทำการศึกษาผลของค่าความนำไฟฟ้าและค่าความเข้มข้นของอนุภาคภายใต้สนามไฟฟ้าด้วย

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