

**ADMICELLAR POLYMERIZATION OF DOPED POLYPYRROLE AND  
POLYTHIOPHENE ON NATURAL RUBBER**



**Adisorn Chirasakulkarun**

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for the Degree of Master of Science  
The Petroleum and Petrochemical College, Chulalongkorn University  
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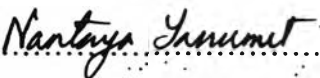
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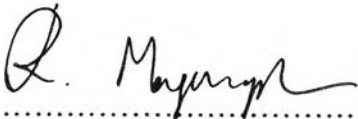
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**By:** Adisorn Chirasakulkarun  
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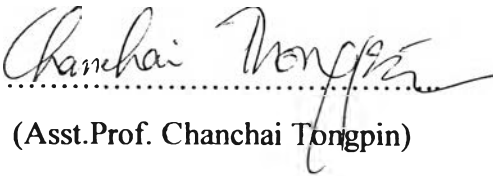
Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfillment of the requirements for the Degree of Master of Science.

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

**Thesis Committee:**

  
.....  
(Assoc. Prof. Rathanawan Magaraphan)

  
.....  
(Asst.Prof. Hathaikarn Manuspiya)

  
.....  
(Asst.Prof. Chanchai Tongpin)

## บทคัดย่อ

อดิศร จิระสกุลการุญ : ชื่อหัวข้อวิทยานิพนธ์ การเตรียมและทดสอบคุณสมบัติเม็ดยางธรรมชาติที่เคลือบพอลิเมอร์นำไฟฟ้า(พอลิไพโรลและพอลิไทโอฟีน) ด้วยวิธีการแอคไมเซลล์. (Admicellar Polymerization of dope conductive polymers on natural rubber.)  
 อ.ที่ปรึกษา : รศ. ดร. รัตนวรรณ มกรพันธุ์ 350 หน้า

พอลิไพโรล(PPy) และพอลิไทโอฟีน(PTh) จัดเป็นพอลิเมอร์ที่คุณสมบัติในการนำไฟฟ้าได้ดี แต่มีข้อจำกัดในความสามารถการขึ้นรูปและความยืดหยุ่นของวัสดุประเภทนี้ไม่ดีนัก วิธีการแก้ปัญหาสามารถทำได้โดยใช้จากการใช้วิธีการแอคไมเซลล์ ด้วยเทคนิคอิโตรเคมี ทำโดยการเคลือบแบบบางของฟิล์มพอลิเมอร์บนพื้นผิวที่มีประจุ โดยการใช้สารลดแรงตึงผิวเป็นแม่แบบ งานวิจัยนี้ใช้เม็ดยางธรรมชาติเป็นวัสดุที่จะถูกเคลือบด้วยชั้นของสารลดแรงตึงผิวโซเดียมโดเดซิลซัลเฟต (SDS) โดยทำการศึกษาจากการเพิ่มปริมาณพอลิเมอร์ในยางธรรมชาติที่ถูกเคลือบด้วยสารลดแรงตึงผิว จากนั้นใช้เทคนิคการดูคลื่นแสงรังสีอินฟราเรดแบบฟูเรียรทรานสฟอร์ม เพื่อยืนยันความสำเร็จในการสังเคราะห์ การทดสอบคุณสมบัติการทนต่ออุณหภูมิของเม็ดยางที่ผ่านกระบวนการเคลือบผิวแล้วพบว่าอุณหภูมิในการสลายตัวเพิ่มสูงขึ้นเมื่อเทียบกับพอลิไพโรลและพอลิไทโอฟีนที่บริสุทธิ์ ซึ่งแสดงให้เห็นว่าเม็ดยางเคลือบผิวมีคุณสมบัติในการทนความร้อนที่ดีขึ้น ในด้านคุณสมบัติเชิงกลของเม็ดยางเคลือบผิวก็ได้รับการปรับปรุงให้ดีขึ้นเช่นกัน โดยเม็ดยางเคลือบผิวจะมีความแข็งที่มากกว่าเม็ดยางธรรมชาติ และจากผลการศึกษาคุณสมบัติในการนำไฟฟ้าของเม็ดยางเคลือบผิวพบว่ามีการนำไฟฟ้าประมาณ  $10^{-6}$  ถึง  $10^{-4}$  S/cm ซึ่งมีค่ามากกว่าค่าการนำไฟฟ้าของยางธรรมชาติหลายเท่า เนื่องจากโดยปกติยางธรรมชาติมีค่าการนำไฟฟ้าเพียง  $10^{-15}$  S/cm .

## ABSTRACT

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Polypyrrole(PPy) and polythiophene(PTh) are good electrically conductive polymers; however, they have poor processibility and their flexibility is limited. To overcome these limitations, electrochemical and admicellar polymerization with Sodium Dodecyl Sulfate (SDS) is used. The admicellar polymerization of PPy and PTh by electrochemical method over natural rubber particles is investigated by varying monomer content and applied voltages. The success of synthesis was confirmed by density, FTIR, SEM, TGA, and TEM. Mechanical properties of admicelled rubber were revealed by tensile strength and hardness test. The conductivity of the modified rubber is about  $10^{-9}$  to  $10^{-4}$  S/cm for PPy and about  $10^{-12}$  to  $10^{-6}$  S/cm, both of which are much higher than that of natural rubber by several orders (the conductivity of pure natural rubber is about  $10^{-15}$  S/cm).

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