

**ADMICELLAR POLYMERIZATION IN A CONTINUOUS
STIRRED TANK REACTOR: EFFECTS OF SURFACTANT AND
INITIATOR LOADINGS**

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ABSTRACT

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A filler is normally added to a rubber to improve its performance in commercial applications. The use of silica as a filler in rubber compounds provides beneficial properties such as improved tensile strength and abrasion resistance. However, a major problem with using silica as a filler is its poor compatibility with rubber. Better compatibility between the two components can be achieved by using admicellar polymerization of organic monomers (e.g. styrene and isoprene) solubilized inside surfactant bilayers adsorbed onto the silica surface, thus giving silicas modified with co-monomers. In this work, surfactant and initiator loadings were optimized to reduce the amounts of both materials needed. Admicellar polymerization on silica fillers was carried out in a continuous reactor. Hi-Sil[®]255, cetyltrimethylammonium bromide, styrene and isoprene were used as filler, surfactant and co-monomers, respectively. Scanning electron micrographs and FT-IR results confirmed the presence of polymer on the silica surface. The amount of polymer formed correlated with the amounts of surfactant and initiator used. The modified silica was tested for rubber compounding and the rubber specimens with different modified silicas were tested for mechanical properties. The results showed that the rubber properties can be maintained by reducing the amounts of surfactant and initiator used.

บทคัดย่อ

ธีระพงษ์ เกียรติดำเนินงาม : วิธีแอดไมเซลล์าร์โพลีเมอไรเซชันในเครื่องปฏิกรณ์แบบต่อเนื่อง: ผลกระทบของปริมาณสารลดแรงตึงผิวและสารก่อปฏิกิริยา (Admicellar Polymerization in a Continuous Stirred Tank Reactor: Effects of Surfactant and Initiator Loadings) อ. ที่ปรึกษา : รศ. ดร. สุเมธ ชวเดช, ผศ. ดร. ปราโมช รังสรรค์วิจิตร, ดร. นุชนาฏ วรรณอง, รศ. ดร. จอห์น เฮซ โอ เฮเวอร์ และ ศ. ดร. เจฟฟรีย์ เฮซ ฮาร์เวลล์ 75 หน้า ISBN 974-17-2309-1

โดยปกติมีการเติมสารเติมแต่งถูกเติมลงไปในยางเพื่อปรับปรุงคุณสมบัติในเชิงพาณิชย์ สารเติมแต่งชนิดหนึ่งที่นิยมใช้ ได้แก่ ซิลิกา การใช้ซิลิกาในสารประกอบของยาง ทำให้เกิดผลดีต่อคุณสมบัติของยาง เช่น เพิ่มการเสริมแรง และค่าต้านทานการขาดุด อย่างไรก็ตาม ปัญหาหลักในการใช้ซิลิกาเป็นสารเติมแต่งคือ ผลของความเป็นเนื้อเดียวกันกับยางที่ไม่ดี อย่างไรก็ตาม การเพิ่มการรวมเป็นเนื้อเดียวกันของส่วนประกอบทั้งสองนี้ ทำได้โดยอาศัยกระบวนการแอดไมเซลล์าร์โพลีเมอไรเซชันของโมโนเมอร์ (เช่น สไตรีน และไอโซพรีน) ละลายในชั้นของสารลดแรงตึงผิว ซึ่งดูดซับบนพื้นผิวของซิลิกาเพื่อให้เกิดการปรับปรุงซิลิกาด้วยโค-โมโนเมอร์ ในงานวิจัยนี้ได้ลดปริมาณของสารลดแรงตึงผิวและสารก่อปฏิกิริยา เพื่อศึกษาผลกระทบดังกล่าวต่อคุณสมบัติของซิลิกาที่ได้รับการปรับปรุงและยาง การทดลองนี้ ใช้เครื่องปฏิกรณ์แบบต่อเนื่องโดยวิธีแอดไมเซลล์าร์โพลีเมอไรเซชันกับสารเติมแต่งซิลิกา ใช้ซิลิกาไฮซิล 255 เซติลไตรเมทิลแอมโมเนียมโบรไมด์ สไตรีนและไอโซพรีน เป็นสารเติมแต่ง สารลดแรงตึงผิวและโค-โมโนเมอร์ ตามลำดับ ผลของสแกนนิ่งอิเล็กตรอนไมโครกราฟและฟูเรียรานฟอรัมอินฟราเรด พิสูจน์ว่ามีพอลิเมอร์ปรากฏบนผิวของซิลิกา ปริมาณของพอลิเมอร์ที่ปรากฏมีความสัมพันธ์กับปริมาณของสารลดแรงตึงผิวและสารก่อปฏิกิริยาที่ใช้ ซิลิกาที่ได้รับการปรับปรุงแล้วได้ถูกนำทดสอบคุณสมบัติของยางทางกลศาสตร์ จากผลการทดลองแสดงให้เห็นว่า คุณสมบัติของยางยังคงเดิม เมื่อลดปริมาณของสารลดแรงตึงผิวและสารก่อปฏิกิริยาที่ต้องใช้

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