

ผลของสารคุณค่าวัสดุเล่นต่อการเสริมแรงด้วยอินซิทูชิลิกาของยางธรรมชาติ

โดยปฏิกริยาโซล-เจลในน้ำยาาง

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ศูนย์วิทยทรัพยากร อุժลังกรอ้มมหาวิทยาลัย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตร์มหาบัณฑิต

สาขาวิชาปิโตรเคมีและวิทยาศาสตร์พลิเมอร์

คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2547

ISBN 974-53-1341-6

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

EFFECTS OF SILANE COUPLING AGENT ON *IN SITU* SILICA
REINFORCEMENT OF NATURAL RUBBER
BY SOL-GEL REACTION IN LATEX

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Petrochemistry and Polymer Science

Faculty of Science

Chulalongkorn University

Academic Year 2004

ISBN 974-53-1341-6

Thesis Title Effects of Silane Coupling Agent on *In situ* Silica Reinforcement
of Natural Rubber by Sol-gel Reaction in Latex

By Miss Nantida Niyompanich

Field of study Petrochemistry and Polymer Science

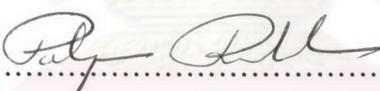
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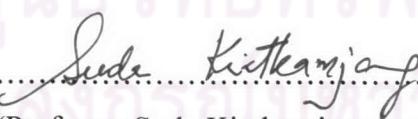
Accepted by the Faculty of Science, Chulalongkorn University in Partial
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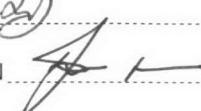

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นันทิดา นิยมพานิช: ผลของสารคุ่มwarenต่อการเสริมแรงด้วยอินซิทูซิลิกาของยางธรรมชาติโดยปฏิกิริยาโซล-เจลในน้ำยาง. (EFFECTS OF SILANE COUPLING AGENT ON *IN SITU* SILICA REINFORCEMENT OF NATURAL RUBBER BY SOL-GEL REACTION IN LATEX) อาจารย์ที่ปรึกษา: ผู้ช่วยศาสตราจารย์ ดร. วราภูณิ ตั้งพสุธาดาล, อาจารย์ที่ปรึกษาร่วม: ศาสตราจารย์ ดร. สุดา เกียรติกำจรวงศ์; 65 หน้า.

ISBN 974-53-1341-6

ซิลิกาที่มีการปรับปรุงพื้นผิวได้จากการกระบวนการโซล-เจลของเททระเออกซีไซเลน (TEOS) ซึ่งเป็นตัวเหนี่ยวนำให้เกิดซิลิกาภายในเมทริกซ์ของยาง โดยมีบิส-(3-ไทรเออกซีไซลิลโพธิล) เททระซัลไฟด์ (TESPT) ซึ่งเป็นสารคุ่มwaren กระบวนการโซล-เจลในน้ำยางธรรมชาติเข้มข้นเกิดได้สมบูรณ์โดยใช้เวลา 7 วันที่อุณหภูมิ 50 °ซ. อนุภาคซิลิกาที่เกิดขึ้นมีการกระจายตัวอย่างทั่วถึงในเมทริกซ์ของยาง มีขนาดเส้นผ่าศูนย์กลางอยู่ในระดับเล็กกว่าไมโครเมตร การศึกษาอิทธิพลของปริมาณ TEOS, TESPT และแเอมโมเนียมต่อสมบัติเชิงกลของคอมโพสิตนั้นกระทำโดยใช้การออกแบบการทดลองแบบแฟกทอร์เรียลสองระดับ ซึ่งพบว่าปริมาณของ TEOS และ TESPT มีอิทธิพลต่อเทนไซล์มอดูลัสที่ 300 เปอร์เซนต์การยืด ค่าการหักเหเฉียด และค่าความแข็ง โดยไม่มีความจำเป็นต้องเติมแเอมโมเนียมเพิ่มในน้ำยางธรรมชาติซึ่งมีอยู่แล้วร้อยละ 0.7 นอกจากนี้ TESPT ใช้ในการเพิ่มอัตราเร็วในการเกิดปฏิกิริยาโซลเฟอร์วัลค่าในเซ็นต์

ศูนย์วิทยทรัพยากร จุฬาลงกรณ์มหาวิทยาลัย

สาขาวิชา ป๊อติรเเคมีและวิทยาศาสตร์พลิเมอร์ ลายมือชื่อนิสิต นันทิดา นิยมพานิช
ปีการศึกษา 2547 ลายมือชื่ออาจารย์ที่ปรึกษา 
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม 

4572340823: MAJOR PETROCHEMISTRY AND POLYMER SCIENCE

KEYWORD: NATURAL RUBBER/ TETRAETHOXYSILANE/ SILICA/ SOL-GEL
PROCESS/ BIS-(3-TRIETHOXYSILYLPROPYL)TETRASULFIDE

NANTIDA NIYOMPANICH: EFFECTS OF SILANE COUPLING AGENT
ON *IN SITU* SILICA REINFORCEMENT OF NATURAL RUBBER BY
SOL-GEL REACTION IN LATEX. THESIS ADVISOR: ASST. PROF.
VARAWUT TANGPASUTHADOL, Ph.D. THESIS CO-ADVISOR: PROF.
SUDA KIATKAMJORNWONG, Ph.D.; 65 pp. ISBN: 974-53-1341-6

Modified silica was generated in NR matrix by a sol-gel process of tetraethoxysilane (TEOS) as a silica precursor in the presence of bis-(3-triethoxysilylpropyl)tetrasulfide (TESPT) as a coupling agent. The sol-gel process carried out in the concentrated NR latex, which was completed within 7 days at 50°C. The silica particles were well dispersed in the NR matrix and the particle diameter was in a submicron range. The influences of the amount of TEOS, TESPT and ammonia on the mechanical properties of the composites were investigated by a statistical analysis of the 'two-level factorial design' experiment. It was found that its tensile modulus at 300% elongation, tear strength and hardness were affected by the TEOS and TESPT content. There was no need to add more ammonia to the concentrated NR latex which contained 0.7% NH₃. Moreover, the use of TESPT in the process increased the rate of sulfur vulcanization.

Field of study Petrochemistry and Polymer Science Student's signature Nantida Niyompanich
Academic year 2004 Advisor's signature Varawut Tangpasuthadol

Co-advisor's signature Suda Kiatkamjornwong

ACKNOWLEDGEMENTS

I would like to express gratitude to my advisor, Assistant Professor Varawut Tangpasuthadol and my co-advisor, Professor Suda Kiatkamjornwong for their invaluable suggestion, guidance and kindness throughout the course of this work.

I am sincerely grateful to Professor Pattarapan Prasassarakich; Associate Professor Wimonrat Trakarnpruk and Dr. Amarawan Intasiri for their invaluable comments and suggestions as serving as the committee members.

I am also thankful for the research financial supports from Research Team Aid (RTA) Grant, Thailand Research Fund [Professor Suda Kiatkamjornwong] and Thai Government Research Fund [The Bureau of the Budget of the Prime Minister]. I would like to thank JJ-Degussa (Thailand) Co., Ltd. for material supplies. I appreciate the technical assistance by the staff from the Rubber Research Institute of Thailand (RRIT), National Metal and Materials Technology Center (MTEC) and from Scientific and Technological Research Equipment Center (STREC), Chulalongkorn University. My special thankfulness is to Dr. Pasaree Laokijcharoen, and the National Metal and Materials Technology Center (MTEC) for their assistances with cryogenic microtome.

Moreover, I appreciate comments, helping, and warm friendship from all members of Varawut and Vipavee groups in Organic Synthesis Research Unit.

Finally, I would like to express my deepest gratitude to my family for their love, encouragement and support throughout my entire study.

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LIST OF ABBREVIATIONS

| | |
|------------|---|
| BR | : Butadiene rubber |
| °C | : Degrees Celsius |
| CP MAS NMR | : Cross-polarization magic angle spinning |
| DMA | : Dynamic mechanical analysis |
| ENR | : Epoxidized natural rubber |
| HA | : High ammonia |
| LA | : Low ammonia |
| MBTS | : Mercaptobenzothiazole disulfide |
| mm | : Millimeter |
| MPa | : Mega Pascal |
| γ-MPS | : γ-Mercaptopropyltrimethoxysilane |
| N | : Newton |
| NBR | : Acrylonitrile-butadiene rubber |
| NR | : Natural rubber |
| phr | : Part per 100 grams of rubber |
| rpm | : Revolution per minute |
| SBR | : Styrene-butadiene rubber |

| | |
|-------|--|
| SEM | : Scanning electron microscopy |
| TEM | : Transmission electron microscopy |
| TEOS | : Tetraethoxysilane |
| TESPT | : Bis-(3-triethoxysilylpropyl)tetrasulfide |
| TMTD | : Tetramethyl thiuram disulfide |
| ZnO | : Zinc oxide |

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