

**SLOW CRACK GROWTH AND MECHANICAL PROPERTIES OF  
POLYPROPYLENE NANOCOMPOSITES**

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A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Science  
The Petroleum and Petrochemical College, Chulalongkorn University  
in Academic Partnership with  
The University of Michigan, The University of Oklahoma  
and Case Western Reserve University

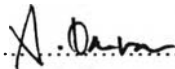
1998

ISBN 974-638-477-5


**Thesis Title** : Slow Crack Growth and Mechanical Properties of  
Polypropylene Nanocomposites  
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**Program** : Polymer Science  
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## ABSTRACT

# # 962009 : POLYMER SCIENCE PROGRAM

KEY WORDS : Polypropylene / Nanocomposite / Montmorillonite /  
Slow crack growth / Mechanical Properties

Saengpetch : Slow Crack Growth and Mechanical Properties of  
Polypropylene Nanocomposites. Thesis Advisors : Asst. Prof. Steven D.  
Hudson, Assoc. Prof. Anuvat Sirivat, 101 pp. ISBN 974-638-477-5

The natural sodium montmorillonite was modified by grafting with a silane coupling agent and maleic anhydride polypropylene (MAPP) to produce MAPP chain-grafted fillers for PP. The wide angle x-ray diffraction and diffuse reflectance infrared spectroscopy results indicated the expansion of interlayer spacing of the silicate clay and confirmed the grafting reaction. Transmission Electron Microscopy results revealed that modified silicate layers were finely dispersed, some as individual silicate layer and some were stacked in thin layers. Nanocomposites were prepared by melt blending fillers with PP on a two roll mill. After preparing the composites, the tensile, impact and slow crack growth properties were measured. The results of the mechanical testings indicated that the effect of tie molecules occurred only under large strain condition at low percent filler content. In the slow crack growth testings, nanocomposites required a longer time to initiate fracture than pure PP. The time to initiate fracture increased with the molecular weight of the PP matrix.

## บทคัดย่อ

แสงเพชร อิศระพานิชกิจ : คุณสมบัติการเกิดรอยแยกและคุณสมบัติเชิงกลของนาโนคอมโพสิตพอลิโพรพิลีน (Slow Crack Growth and Mechanical Properties of Polypropylene Nanocomposites) อ.ที่ปรึกษา : ผศ. ดร. สตีเวน ฮัดสัน (Asst. Prof. Steven D. Hudson) และ รศ. ดร. อนุวัฒน์ สิริวัฒน์ 101 หน้า ISBN 974-638-477-5

โพลีเอทิลีนโมโนเมอร์ไอโคโนที่ถูกปรับสภาพผิวโดยการเชื่อมต่อกับสารต่อเชื่อม 3-อะมิโนโพรพิลไดเมทิลเอทอกซีไซเลน และมาเลอิก แอนไฮไดรด์ โมดิฟายด์พอลิโพรพิลีน เพื่อสร้างสารตัวเติมสำหรับพอลิโพรพิลีน ผลการทดสอบด้วยเครื่องเอกซ์เรย์และอินฟราเรดแสดงการแยกของชั้นซิติลเกิดและยับยั้งการเกิดปฏิกิริยา ผลการวิเคราะห์ด้วยกล้องจุลทรรศน์อิเล็กตรอนแสดงว่าซิติลเกิดชนิดที่ผ่านการปรับสภาพผิวแล้ว เมื่อนำมาเติมลงในพอลิโพรพิลีน จะมีการกระจายตัวอย่างดี บางส่วนเป็นชั้นเดี่ยวในขณะที่บางส่วนซ้อนกันเป็นชั้นๆ นาโนคอมโพสิตถูกเตรียมโดยการผสมสารตัวเติมกับพอลิโพรพิลีนโดยเครื่องทุโรลมิล (two roll mill) คอมโพสิตนี้ถูกทดสอบคุณสมบัติการทนต่อแรงดึง การทนต่อแรงกระแทก และการต้านทานการเกิดรอยแยก การทดสอบสมบัติเชิงกลพบว่า การปรับปรุงสมบัติเชิงกลซึ่งเป็นผลมาจากไทล์โมเลกุลเกิดขึ้นเมื่อเติมสารตัวเติมในปริมาณน้อยๆ และจากการศึกษาคุณสมบัติในการต้านทานต่อการเกิดรอยแยกพบว่า นาโนคอมโพสิตมีความต้านทานต่อการเกิดรอยแยกมากกว่าพอลิโพรพิลีน ความต้านทานต่อการเกิดรอยแยกจะเพิ่มขึ้นในคอมโพสิตของพอลิโพรพิลีนที่มีน้ำหนักโมเลกุลสูง

## ACKNOWLEDGMENTS

The author would like to thank TOA group of companies and the Petroleum and Petrochemical College, Chulalongkorn university, for providing a scholarship to study in Polymer Science Program. She is indebted to the professors who taught her at the College. She also gratefully acknowledges Thai Petrochemical Industry Publish Co. Ltd. for their supported in providing raw materials.

She greatly appreciates the efforts of her research advisor, Asst. Prof. Steven D. Hudson, who originated her thesis and gave valuable suggestions. She would like to give special thanks to my co-advisor, Assoc. Prof. Anuvat Sirivat who gave guidance, directions and helpful suggestions in this work, proof - reading of thesis writing throughout this research. Her thanks are also extended to all of the staffs of the Petroleum and Petrochemical College for their help in my thesis work.

She would like to give special thanks to her family for their love, understanding, and encouragements. Thanks also go to all of my friends for their suggestions, encouragements, kindness, and invaluable assistances in many aspects during my two years here.

## TABLE OF CONTENTS

	<b>PAGE</b>
Title Page	i
Abstract	iii
Acknowledgments	v
List of Tables	ix
List of Figures	x
<b>CHAPTER</b>	
<b>I INTRODUCTION</b>	
1.1 Background	1
1.2 Slow Crack Growth	3
1.3 Clay (Kunipia F)	5
1.4 Silane Coupling Agent	7
1.5 Literature Survey	9
1.6 Objectives	15
<b>II EXPERIMENTAL SECTION</b>	
2.1 Materials	16
2.2 Nanocomposite Preparation	18
2.2.1 Nanofiller Preparation	18
2.2.2 Nanocomposite Preparation	23
2.3 Characterization Techniques	27
2.4 Mechanical Testing	28
2.4.1 Tensile Testing	28

<b>CHAPTER</b>	<b>PAGE</b>
2.4.1 Impact Testing	29
2.4.2 Slow Crack Growth Testing	29
2.5 Scope of Experiment	32
<b>III RESULTS AND DISCUSSION</b>	
3.1 Preparation Methods	34
3.2 Characterization Results	38
3.2.1 The Characterization of Modified Silicate Clay	38
3.2.2 The Characterization of the Grafting MAPP to the Modified Silicate Clay	40
3.3 Mechanical Properties Results	44
3.3.1 Tensile and Impact Properties	44
3.3.2 Slow Crack Growth Properties	51
<b>IV CONCLUSIONS</b>	<b>59</b>
<b>REFERENCES</b>	<b>60</b>
<b>APPENDICES</b>	<b>63</b>
<b>CURRICULUM VITAE</b>	<b>101</b>

**LIST OF TABLES**

<b>TABLE</b>		<b>PAGE</b>
2.1	Dimensions of tensile testing specimen	25
2.2	Dimensions of Izod impact testing specimen	26
2.3	Scope of experiment	32
3.1	The optimal conditions of percent elongation at break of each composite	48



## LIST OF FIGURES

FIGURE	PAGE	
1.1	Picture of initial steps in the deformation of polyethylene	3
1.2	Molecular formula of Na <sup>+</sup> montmorillonite	6
1.3	Picture of the structure of clay	6
2.1	Structure of Na <sup>+</sup> montmorillonite	16
2.2	Structure of 3-aminopropyl dimethylethoxysilane	17
2.3	Dimensions of tensile testing specimen	25
2.4	Dimensions of Izod impact testing specimen	26
2.5	Dimensions of slow crack growth testing specimen	27
2.6	Specimen of slow crack growth test	30
2.7	Our homemade SCG apparatus	31
3.1	Young's modulus of PP3/2/y/10 composites at 26°C prepared from the old method and the new method	34
3.2	Tensile strength at yield of PP3/2/y/10 composites at 26°C prepared from the old method and the new method	35
3.3	Percentage of elongation at yield of PP3/2/y/10 composites at 26°C prepared from the old method and the new method	36
3.4	Percentage of elongation at break of PP3/2/y/10 composites at 26°C prepared from the old method and the new method	36
3.5	Impact strength of PP3/2/y/10 composites at 26°C prepared from the old method and the new method	37
3.6	XRD intensity versus angle for pure clay and the modified silicate clay	39
3.7	Intercalating behavior of clay (Na <sup>+</sup> montmorillonite)	39

<b>FIGURE</b>	<b>PAGE</b>
3.8 XRD intensity versus angle for the filler prepared from modified clay and MAPP	40
3.9 Model of the MAPP chain grafted filler	41
3.10 DRIFT results of MAPP, filler containing 5 % clay content and filler containing 20% clay content	42
3.11 TEM micrograph of PP1/2/10/2 composites	43
3.12 Effect of filler content on Young's modulus of PP1 composite at 26°C	44
3.13 Effect of filler content on tensile strength at yield of PP1 composites at 26°C	45
3.14 Effect of filler content on % elongation at yield of PP1 composites at 26°C	46
3.15 Effect of filler content on % elongation at break of PP1 composites at 26°C	47
3.16 Effect of filler content on impact strength of PP1/2/10/z, PP1/2/60/z and PP1/2/100/z composites at 26°C	48
3.17 Effect of $M_w$ on Young's modulus of 2/y/10 composites at 26°C	49
3.18 Effect of $M_w$ on tensile strength at yield of 2/y/10 composites at 26°C	50
3.19 Effect of $M_w$ on % elongation at yield of 2/y/10 composites at 26°C	50
3.20 Effect of $M_w$ on % elongation at break of 2/y/10 composites at 26°C	51
3.21 Effect of $M_w$ on impact strength of 2/y/10 composites at 26°C	51

<b>FIGURE</b>		<b>PAGE</b>
3.22	Model shows tie molecule in the nanocomposite	53
3.23	Crack opening displacement of pure PP1 and pure PP3	54
3.24	Crack length of pure PP1 and pure PP3	54
3.25	Crack opening displacement of PP1/2/60/10 composites and PP3/2/60/10 composites	55
3.26	Crack length of PP1/2/60/10 composites and PP3/2/60/10 composites	55
3.27	Crack opening displacement of pure PP3, PP3/2/20/10 composites and PP3/2/60/10 composites	57
3.28	Crack length of pure PP3, PP3/2/20/10 composites and PP3/2/60/10 composites	58
3.29	Crack opening displacement of pure PP1, PP1/2/20/10 composites and PP1/2/60/10 composites	58
3.30	Crack length of pure PP1, PP1/2/20/10 composites and PP1/2/60/10 composites	59