

การใช้สมการซิมเพล็กซ์สำหรับทำนายสมบัติเชิงกลของโพลิเมอร์ผสม

นายศิริศาส เอื้อใจ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

สาขาวิชาวิทยาศาสตร์โพลิเมอร์

บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2540

ISBN 974-638-918-1

ลิขสิทธิ์ของบัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

USING SIMPLEX EQUATION FOR PREDICTING MECHANICAL PROPERTIES  
OF POLYMER BLENDS

Mr. Sirisart Ouajai

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

Program of Polymer Science

Graduate School

Chulalongkorn University

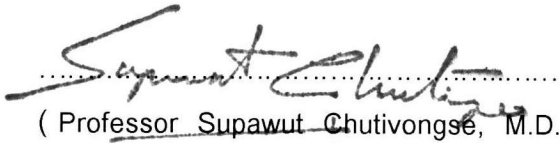
Academic Year 1997

ISBN 974-638-918-1

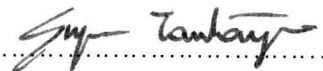
Thesis Title Using Simplex equation for Predicting Mechanical Properties  
of Polymer Blends.  
By Mr. Sirisart Ouajai  
Program Polymer Science  
Thesis Advisor Associate Professor Kroekchai Sukanjanajtee, Ph.D.

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ศิริศาส เอื้อใจ : การใช้สมการซิมเพล็กซ์สำหรับทำนายสมบัติเชิงกลของโพลิเมอร์ผสม (USING SIMPLEX EQUATION FOR PREDICTING MECHANICAL PROPERTIES OF POLYMER BLENDS) อ. ที่ปรึกษา : รศ. ดร. เกริกชัย สุกาญจน์จิติ, 180 หน้า. ISBN 974-638-918-1.

วัตถุประสงค์ของงานวิจัยนี้ คือศึกษาถึงการใช้สมการซิมเพล็กซ์ เพื่อทำนายสมบัติเชิงกลของโพลิเมอร์ผสมชนิดต่างๆ และเตรียมโพลิเมอร์ผสมระหว่างโพลิเอทิลีนชนิดความหนาแน่นสูงกับโพลิโพรพิลีน เพื่อศึกษาผลของน้ำหนักโมเลกุลของโพลิเอทิลีน ต่อพารามิเตอร์ของการกระทำระหว่างกันในสมการนี้

สมบัติเชิงกลที่ขึ้นกับอัตราส่วนการผสม ประกอบด้วย โมดูลัส ความต้านทานแรงดึง ความต้านทานแรงกระทำ และเปอร์เซ็นต์การยืดที่จุดขาด ถูกค้นคว้ารวบรวม พบว่ามี 89 สมบัติเชิงกล จากทั้งหมด 120 สมบัติ ที่ผลจากสมการเข้ากันได้ดีกับการทดลองในเอกสารที่ค้นคว้า ส่วนที่เหลือเกิดการเบี่ยงเบนของข้อมูลมาก ส่วนใหญ่เป็นสมบัติความต้านทานแรงกระทำ และ เปอร์เซ็นต์การยืดที่จุดขาด ซึ่งมักจะมีสาเหตุจากแรงกระทำระหว่างเฟส

น้ำหนักโมเลกุลของโพลิเอทิลีน ชนิดความหนาแน่นสูง 4 ตัว อยู่ในช่วงประมาณ 38,000-102,000 และน้ำหนักโมเลกุลของโพลิโพรพิลีน ประมาณ 122,000 โพลิเมอร์ผสมระหว่างโพลิเอทิลีนชนิดความหนาแน่นสูงกับโพลิโพรพิลีน ถูกผสมด้วยเครื่องหลอมอัดรีดสกรูคู่ ค่าโมดูลัส และ ค่าความต้านทานแรงดึงสามารถทำนายได้ด้วยสมการซิมเพล็กซ์ และ พารามิเตอร์ของการกระทำระหว่างกัน มีแนวโน้มลดลงตามน้ำหนักโมเลกุลของโพลิเอทิลีนที่ลดลง จากการศึกษาวิเคราะห์เชิงความร้อน พบว่าความเป็นผลึก ส่งผลโดยตรงต่อสมบัติเชิงกลที่แสดงออกมา ของโพลิเมอร์ผสมเหล่านี้

ภาควิชา ..... สหสาขาวิชาปิโตรเคมี-โพลิเมอร์  
สาขาวิชา ..... วิทยาศาสตร์โพลิเมอร์  
ปีการศึกษา ..... 254 0

ลายมือชื่อนิสิต .....  
ลายมือชื่ออาจารย์ที่ปรึกษา .....  
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม .....

# # C785286 : MAJOR POLYMER SCIENCE  
KEY WORD: POLYMER BLEND / MECHANICAL PROPERTY / EQUATION

SIRISART OUJAI : USING SIMPLEX EQUATION FOR PREDICTING MECHANICAL PROPERTIES OF  
POLYMER BLENDS. THESIS ADVISOR : ASSOC. PROF. KROEKCHAI SUKANJANAJTEE, Ph.D.  
180 pp. ISBN 974-638-918-1.

The objective of this research work is to study the use of Simplex equation for predicting mechanical properties of several kinds of polymer blends. In addition, polymer blend of polypropylene(PP) with four different molecular weights of high-density polyethylene(HDPE) will be prepared to study how the interaction parameter in Simplex equation depends on the molecular weight of HDPE in the blends.

Mechanical properties as a function of composition, composed of modulus, tensile strength, impact strength and elongation at break of various blends, were searched and collected. About 89 from 120 sets of mechanical properties fit fairly well with experimental properties collected, although there are deviations in some systems especially in elongation and impact strength due to interfacial adhesion effect between phase.

Molecular weight of four polyethylene are in the ranges of 38,000-102,000 while molecular weight of polypropylene equals to 122,00 approximately. HDPE-PP blends were prepared in a twin screw extruder. Their modulus and yield strength can be predicted by Simplex equation, and the interaction parameter tends to decline when the molecular weight of polyethylene decrease. From thermal analysis, degree of crystallinity directly affects the mechanical behavior of these blends.

ภาควิชา..... Petrochemistry and Polymer Science

สาขาวิชา..... Polymer Science

ปีการศึกษา..... 1997

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## ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my advisor, Associate Professor Dr. Kroekchai Sukanjanajtee, for providing helpful advice, criticism and encouragement throughout this study and reviewing this thesis.

I am so grateful to the department of Industrial Chemistry, Faculty of Applied Science, King Mongkut's Institute of Technology, North Bangkok for the uses of equipment and facilities. I also wish to thank Assoc. Prof. Dr. Supawan Tantayanon, Assist. Prof. Dr. Prapaipit Chamsuksai Ternai, Assist. Prof. Dr. Nuanphun Chantarasiri and Assist. Prof. Narumol Kreua-ongarjnukool for acting on committee as chairperson and members respectively.

Finally, I would like to express my greatest appreciation to my family for their support and encouragement throughout the course.

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## ABBREVIATIONS

DGEBA	Diglycidyl ether of bisphenol-A
EME	Elastomer-modified epoxy
EVA	Poly(ethylene-co-vinyl acetate)
LCP	Liquid crystalline polymer
PA	Polyamide
PAr	Polyacrylate
PEEK	Poly(ether ether ketone)
PEI	Poly(ether imide)
PEMA	Poly(ethyl methacrylate)
PES	Poly(ether sulfone)
PHB	Poly(3-hydroxy butylate)
PI	Polyimide
PMIA	Poly(m-phenyleneisophthalamide)
PSF	Polysulfone
PUR	Polyurethane
Zn-EMA	Zn-salt of an ethylene-methacrylic acid copolymer