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APPLICATIONS OF VARIOUS SPINODAL DECOMPOSITION THEORIES TO
SMALL ANGLE LIGHT SCATTERING EXPERIMENTS OF POLYMER BLENDS

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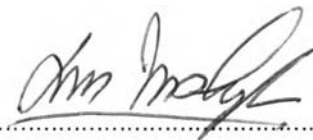
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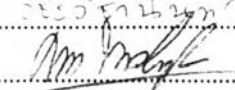
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งานวิจัยนี้เกี่ยวข้องกับการเปรียบเทียบทฤษฎีทางจลนศาสตร์ของการแยกเฟสในพอลิเมอร์ผสมที่อุณหภูมิสูง (สไปนูดอลดีคอมโพสิชัน) ข้อมูลการทดลองที่นำมาใช้ได้จากการวัดโดยใช้เครื่องการกระเจิงแสงที่มุมแคบ (Small Angle Light Scattering) ซึ่งจะมีค่าความเข้มแสง มุมการกระเจิงแสง และเวลา โดยผลการทดลองดังกล่าวได้จาก 2 ชุดการทดลอง คือ ชุดแรกได้จาก พอลิเมอร์ผสมของเตตระเมทิลบิสฟีนอลพอลิคาร์บอเนต (Tetramethyl Bisphenol A polycarbonate, TMPC) และพอลิสไตรีน (Polystyrene, PS) ที่ส่วนประกอบ 30%, 50% และ 70% ของ TMPC ที่อุณหภูมิต่างๆ ชุดการทดลองที่สองได้จากพอลิสไตรีนโคมาเลอิกแอนไฮไดรด์ (Polystyrene co maleic anhydride, SMA) และพอลิเมทิลเมทาคริเลต (Polymethyl methacrylate, PMMA) ที่ส่วนประกอบ 20%, 30% และ 40% ของ SMA ที่อุณหภูมิ 210 °C ข้อมูลทั้งสองชุดจะถูกนำมาเปรียบเทียบกับค่าที่ได้จากการทำนายทางทฤษฎีต่างๆ

จากการศึกษาทฤษฎีต่างๆ เพื่อนำมาอธิบายผลการทดลองพบว่า มี 4 ทฤษฎีซึ่งจะนำมาใช้เพื่อทำนายผลการทดลองที่ใช้ศึกษา โดยทฤษฎีแรกเป็นของ Cahn-Hilliard ซึ่งเป็นที่รู้จักกันดี ต่อมาก็จะมีทฤษฎีของ Langer, Bar-on และ Miller และทฤษฎีของ Nauman ซึ่งดัดแปลงมาจากทฤษฎีของ Cahn-Hilliard และสุดท้ายจะเป็นทฤษฎีของ Akcasu ในการทดลองนี้จะใช้ชุดการทดลองเดียวกันเพื่อจัดให้อยู่ในรูปของสมการในแต่ละทฤษฎีและเปรียบเทียบผลของความผิดพลาดที่เบี่ยงเบนจากทฤษฎีนั้นๆ

จากการนำผลการทดลองมาจัดให้อยู่ในรูปแบบสมการของแต่ละทฤษฎีและคำนวณหาค่าความผิดพลาดพบว่า ทฤษฎีของ Akcasu สามารถอธิบายผลการทดลองได้ดีที่สุด ส่วนทฤษฎีของ Langer, Bar-on และ Miller สามารถอธิบายผลการทดลองส่วนใหญ่ค่อนข้างดีแต่ไม่สามารถอธิบายสมบัติการแยกเฟสได้ดีเท่ากับของ Akcasu ทฤษฎีของ Nauman และ Cahn-Hilliard สามารถใช้อธิบายได้เฉพาะช่วงแรกของการแยกเฟสเท่านั้น อย่างไรก็ตามเราไม่สามารถบ่งชี้ได้ว่าทฤษฎีต่างๆ เหล่านี้จะสามารถใช้ได้อย่างกว้างขวางเนื่องจากจำนวนคู่พอลิเมอร์และชุดข้อมูลที่ใช้มีจำนวนน้อย

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ลายมือชื่อนิสิต ศิริรัตน์ วัชรวิชานันท์
ลายมือชื่ออาจารย์ที่ปรึกษา 
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SIRIRAT WACHARAWICHANANT : APPLICATIONS OF VARIOUS SPINODAL

DECOMPOSITION THEORIES TO SMALL ANGLE LIGHT SCATTERING

EXPERIMENTS OF POLYMER BLENDS. THESIS ADVISOR :

M.L.SUPAKANOK THONGYAI, Ph.D. 231 pp. ISBN 974-332-308-2

This research concerns with the comparison of the kinetics theories of the autonomous phase separation of polymer blends at high temperatures (Spinodal decomposition, SD). Two sets of light scattering data which consist of intensity, angle and times were used. The first one is the blends of Tetramethyl Bisphenol A polycarbonate (TMPC) / Polystyrene(PS) at 30%,50% and 70% of TMPC at various temperatures. The second one is the blend of Polystyrene co maleic anhydride (SMA)/ Polymethyl methacrylate (PMMA) at 20%, 30%, and 40% of SMA at 210 °C. The light scattering data was examined and compared with predicted values from various theories.

There are four famous kinetics theories, which have the data to support the precision of the predictions that used in this study. The well-known theory of Cahn-Hilliard has been used. Further more, the Langer, Bar-on, Müller's theory and the theory of Nauman, which were modified from the Cahn-Hilliard's theory, was investigated. The new theory from Akcasu was also fitted with the data. The two sets of data were fitted with these four theories and compare the percent relative average error that deviate from the data. The percent relative average error from each equation were tested and analysed.

The observations of the error proved that the new theory of Akcasu was the most versatile theory which can be fitted with the two sets of data. The Langer, Bar-on, and Müller fitted results show the flexible of the usage but the values from the theory can not be related to the basics properties of the phase separated of polymer blend as Akcasu's theory can. The theories that invented by Nauman and Cahn-Hilliard, can be well fitted only in the beginning of the spinodal decomposition process. However, we hardly conclude the validity of the theories because of the few pairs of data observed.

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ลายมือชื่ออาจารย์ที่ปรึกษา.....
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Finally, the author would like to dedicate this thesis to her parents, who generously supported, given all their precious love and encouraged her through the years spent on this study.

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