EFFECT OF TRIBLOCK COPOLYMER ON DROP BREAKUP AND COALESCENCE OF IMMISCIBLE BLENDS

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ABSTRACT

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The effect of shear rate and triblock copolymer on blend morphology of three immiscible blends: PS/PI, HDPE/PI and PVAc/PI were investigated. Poly(styrene-b-isoprene-b-styrene) triblock copolymer was used as the compatibilizer. Drop size decreased with increasing shear rate because of the imbalance between the viscous force and the interfacial tension force. Inversely, the PI drop size became larger after the reduction in shear rate. This was because of the coalescence behavior. The drop size of PS/PI system had the smallest size at any shear rates whereas the largest drop size belonged to those of the HDPE/PI blend, as dictated by the interfacial tension parameter. For the effect of triblock copolymer on blend morphology, addition of the block copolymer led to a significant reduction in PI particle size because of the steric hindrance and the swelling effect between the PS segment of block copolymer and the matrix. For the coalescence measurement, the drop size of HDPE/PI, PS/PI and PVAc/PI with 5% SIS triblock copolymer were increased 4%, 1% and 6%, respectively. This was because of the PS/PI system has the highest swelling (S = 0.91) whereas the lowest value belongs to the PVAc/PI system (S = -25.90). Moreover, the saturated block copolymers of all blends were about 2%.

บทคัดย่อ

นายองอาจ อมรพรวิวัฒน์ : อิทธิพลของไตรบล็อคโคพอลิเมอร์ต่อพฤติกรรมของการแตกตัวและการรวมตัวของพอลิเมอร์ผสมที่ไม่เป็นเนื้อเดียวกัน (Effect of Triblock Copolymer on Drop Breakup and Coalescence of Immiscible Blends). อ.ที่ปรึกษา : ศ.ดร. อเล็กซานเดอร์ เอ็ม เจมีสัน และ รศ.ดร. อนุวัฒน์ ศิริวัฒน์ 117 หน้า ISBN 974-331-184-6

งานวิจัยนี้ศึกษาและค้นคว้าอิทธิพลของการเฉือนและไตรบล็อคโคพอลิเมอร์ต่อโครงสร้างภายในของสารผสมที่ไม่เป็นเนื้อเดียวกัน อันได้แก่ พอลิเอททีลีนความหนาแน่นสูง/พอลิไอโซพรีน , พอลิสไตรีน/พอลิไอโซพรีน และพอลิไวนิลอะซีเตต/พอลิไอโซพรีน โดย พอลิ(สไตรีน-บล็อก-พอลิไอโซพรีน-บล็อก-พอลิสไตรีน) ทำหน้าที่เป็นสารเสริมความเข้ากันได้ระหว่างสาร 2 ชนิด. เราพบว่าอนุภาคทรงกลมมีขนาดเล็กลงเมื่ออัตราเร็วของการเฉือนมีค่าสูงขึ้นซึ่งเกิดเนื่องมาจากความไม่สมดุลระหว่างแรงที่พยายามยืดอนุภาคทรงกลมและแรงที่พยายามรักษารูปร่างของอนุภาค. ในทางกลับกัน, เราพบว่าอนุภาคจะมีขนาดใหญ่ขึ้นเมื่ออัตราเร็วของการเฉือนลดลงเนื่องจากพฤติกรรมการรวมตัว. อนุภาคทรงกลมของพอลิสไตรีน/พอลิไอโซพรีนมีขนาดเล็กที่สุดในขณะที่ขนาดของพอลิเอททีลีน/พอลิไอโซพรีนมีค่ามากที่สุด. สำหรับอิทธิพลของไตรบล็อคโคพอลิเมอร์ เราพบว่าไตรบล็อคโคพอลิเมอร์ทำหน้าที่เป็นสารลดขนาดของอนุภาคเนื่องจากการเกิดความเกะกะและการบวมตัวระหว่างส่วนของพอลิสไตรีนในบล็อคโคพอลิเมอร์และสารชนิดหลัก ดังจะเห็นได้จากผลการทดลองว่า พอลิสไตรีน/พอลิไอโซพรีน/ไตรบล็อคโคพอลิเมอร์ 5 เปอร์เซนต์ ซึ่งมีค่าการบวมตัวสูงที่สุดนั้นมีอัตราการเพิ่มขนาดของอนุภาคทรงกลมเนื่องการรวมตัวเพียง 1 เปอร์เซ็นต์ ในขณะที่พอลิไวนิลอะซีเตต/พอลิไอโซพรีน/ไตรบล็อคโคพอลิเมอร์ 5 เปอร์เซนต์ มีอัตราการเพิ่มขนาดของอนุภาคถึง 6 เท่าเนื่องจากมีค่าการบวมตัวต่ำที่สุด.

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