SHEAR-INDUCED CRYSTALLIZATION IN POLY(TRIMETHYLENE TEREPHTHALATE)

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ABSTRACT

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In plastics processing, polymer melts are generally sheared (i.e., they undergo shear flow) which may or may not enhance crystallization rates depending on the favored conformational state of polymer molecules in the crystals. Poly(trimethylene terephthalate) (PTT) is a new type of polyester that has recently been commercialized as a result of the low production cost. In this work, shear-induced crystallization in PTT was investigated from both the melt and the glassy states and in both isothermal and non-isothermal regimes using differential scanning calorimetry technique. In cold crystallization, shear-treated samples were prepared using cone-and-plate and capillary rheometers. The cold crystallization peak temperature for shear-treated samples was also shifted to lower temperatures. A modified differential Nakamura model, which takes into account the effect of shear, was used to analyze the data. A cone-and-plate rheometer was used to investigate the *in situ* shear-induced melt crystallization in PTT. A simplified model describing the effect of shear on the shift in the induction time was used to analyze the data.

บทคัดย่อ

พรพล ศรีโมอ่อน : การศึกษาพฤติกรรมการตกผลึกของพอลิ(ไตรเมทธิลีนเทเรฟ-ทาเลท)ที่ถูกเหนี่ยวนำโดยการเฉือน (Shear-Induced Crystallization of Poly(trimethylene terephthalate) อ. ที่ปรึกษา : ผศ.ดร. พิชญ์ ศุภผล และ รศ.ดร.อนุวัฒน์ ศิริวัฒน์ 189 หน้า ISBN 974-17-2337-7

ในสภาวะการขึ้นรูป ปกติพอลิเมอร์หลอมเหลวจะถูกเฉือนภายใต้แรงเฉือนซึ่งอาจจะเพิ่มอัตราการตกผลึก หรือ เหนี่ยวนำการตกผลึกขึ้นอยู่กับสภาวะการจัดเรียงตัวของพอลิเมอร์โมเลกุลในผลึก พอลิไตรเมธิลีนเทเรฟทาเลท เป็นพอลิเอสเทอร์ชนิดใหม่ที่เหมาะสมในทางการค้าเมื่อไม่นานนี้เนื่องจากต้นทุนในการผลิตที่ต่ำลง ในการศึกษาครั้งนี้ การตกผลึกของพอลิไตรเมธิลีนเทเรฟทาเลทที่ผ่านการเฉือนถูกติดตามโดยใช้เทคนิค differential scanning calorimetry (DSC) ในสภาวะการตกผลึกแบบเย็น ตัวอย่างที่ผ่านการเฉือนถูกเตรียมโดยใช้ cone and plate rheometer และ capillary rheometer อุณหภูมิสูงสุดของการตกผลึกแบบเย็นพบว่า สามารถเกิดที่อุณหภูมิต่ำกว่าเมื่อเปรียบเทียบกับตัวอย่างที่ไม่ผ่านการเฉือน แบบจำลองที่มีการปรับปรุงของ Nakamura ที่คำนึงถึงปัจจัยของการเฉือนถูกนำมาใช้ในการวิเคราะห์ผลการทดลอง cone and plate rheometer สามารถใช้ในการติดตามการตกผลึกของตัวอย่างในสภาวะการตกผลึกจากการหลอมเหลว แบบจำลองอย่างง่ายที่พิจารณาว่า ผลของการเฉือนสามารถเหนี่ยวนำช่วงเวลาที่ใช้ก่อนการตกผลึกถูกใช้อธิบายผลการทดลองด้วย

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