

**CRYSTALLIZATION, MECHANICAL PROPERTIES AND  
PROCESSABILITY OF CALCIUM CARBONATE-FILLED  
SYNDIOTACTIC POLYPROPYLENE**



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**ABSTRACT**

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Calcium carbonate ( $\text{CaCO}_3$ )-filled s-PP was prepared in a self-wiping, co-rotating twin-screw extruder. The effects of  $\text{CaCO}_3$  content (0 to 40% by weight), particle size (1.9, 2.8 and 10.5  $\mu\text{m}$ ), and surface modification (neat, stearic acid-treated, and paraffin-treated) on crystallization behavior, mechanical properties and processability of the compounds were investigated. Both non-isothermal and isothermal crystallization studies indicated that  $\text{CaCO}_3$  acted as a good nucleating agent for s-PP. Nucleation efficiency of  $\text{CaCO}_3$  was found to depend strongly on its crystal structure, surface treatment, and size. Tensile strength was found to decrease, while the Young's modulus increased, with increasing  $\text{CaCO}_3$  content. Both types of surface treatments on  $\text{CaCO}_3$  reduced the tensile strength and the young's modulus, but helped improve impact resistance. Melt viscosity of  $\text{CaCO}_3$ -filled s-PP was found to increase with increasing  $\text{CaCO}_3$  content and decreasing particle size. Both types of surface treatment resulted in a reduction in melt viscosity, probably due to reduced inter-particle interactions and extent of agglomeration of the filler. Morphology observations of the fracture surfaces of  $\text{CaCO}_3$ -filled s-PP samples revealed an improvement in  $\text{CaCO}_3$  dispersion as a result of surface treatment.

## บทคัดย่อ

วิภาศิริ หาญศิริ : การศึกษาผลของแคลเซียมคาร์บอเนตต่อการตกผลึก, สมบัติเชิงกล และความสามารถในการผลิตในซินดิโอแทคติกพอลิโพรพิลีน (Crystallization, Mechanical properties, and Processability of Calcium Carbonate-Filled Syndiotactic Polypropylene) อ. ที่ปรึกษา : ดร. พิชญ์ ศุภผล 56 หน้า ISBN 974-03-1609-3

ซินดิโอแทคติกพอลิโพรพิลีนถูกผสมกับแคลเซียมคาร์บอเนตในเครื่องอัดรีดชนิดเกลียวคู่ งานวิจัยนี้ทำการศึกษาผลของปริมาณ (0-40% โดยน้ำหนัก), ขนาดของอนุภาค (1.9, 2.8 และ 10.5 ไมครอน) และสารเคลือบผิว (กรดสเตียริก และพาราฟิน) ของแคลเซียมคาร์บอเนตต่อการตกผลึก สมบัติเชิงกลและความสามารถในการผลิตในซินดิโอแทคติกพอลิโพรพิลีน จากการศึกษาการตกผลึกทั้งแบบอุณหภูมิคงที่ และอุณหภูมิไม่คงที่พบว่า แคลเซียมคาร์บอเนตเป็นสารก่อผลึกที่ดีสำหรับซินดิโอแทคติกพอลิโพรพิลีน อย่างไรก็ตามความสามารถในการก่อผลึกของแคลเซียมคาร์บอเนตขึ้นกับโครงสร้างผลึกสารเคลือบผิวและขนาดของอนุภาค จากการศึกษาสมบัติเชิงกลพบว่าความทนแรงดึงลดลง แต่ยังมีมอดูลัสเพิ่มขึ้นเมื่อปริมาณแคลเซียมคาร์บอเนตเพิ่มขึ้น เมื่อเคลือบผิวด้วยกรดสเตียริก และพาราฟิน มีผลทำให้ความทนแรงดึงและยังมีมอดูลัสลดลง แต่ทำให้ความทนแรงกระแทกเพิ่มขึ้น ค่าความหนืดของสารประกอบซินดิโอแทคติกพอลิโพรพิลีนและแคลเซียมคาร์บอเนตเพิ่มขึ้นเมื่อปริมาณแคลเซียมคาร์บอเนตเพิ่มขึ้นและขนาดอนุภาคลดลง แต่เมื่อเคลือบผิวแคลเซียมคาร์บอเนตด้วยกรดสเตียริกและพาราฟินช่วยลดแรงดึงดูระหว่างอนุภาค และการรวมตัวของอนุภาค มีผลทำให้ความหนืดลดลง เมื่อศึกษาการกระจายตัวของแคลเซียมคาร์บอเนตพบว่าแคลเซียมคาร์บอเนตที่ถูกเคลือบด้วยกรดสเตียริกและพาราฟินกระจายตัวได้ดีในซินดิโอแทคติกพอลิโพรพิลีน

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