

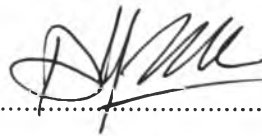
**DIELECTRIC AND PIEZOELECTRIC BEHAVIORS OF CELLULOSE/
PVDF COMPOSITE FILM PREPARED BY MELT MIXING METHOD**

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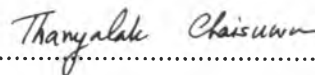


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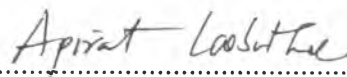
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ABSTRACT

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Keywords: Poly(vinylidene fluoride)/ Cellulose/ Melt process

Poly(vinylidene fluoride) (PVDF) and its copolymers are piezoelectric polymers with growing applications in sensors and actuators. Generally, PVDF demonstrates an ability to convert the mechanical energy into electrical energy and vice versa. In this research, poly(vinylidene fluoride-co-Hexafluoropropylene) (PVDF-HFP)/cellulose composites were fabricated via twin screw extruder to achieve the high dielectric and piezoelectric properties and also utilized as a touch sensor. Two sources of cellulose-based materials, extracted microcrystalline cellulose (MCC) from sugarcane bagasses in 1-20 wt.%, and extracted bacterial cellulose (BC) from Nata de coco in 1-5 wt.%, were provided as an appropriate filler to improve the dipole alignment of PVDF-HFP matrix. The cast film extruder was used to produce the transparent composite films with unique properties. The increment in β -phase crystalline presented with higher amount of cellulose, both MCC and BC. The dielectric constant corresponded to piezoelectric coefficient was enhanced from 2.00 of neat PVDF-HFP to 3.75 with 10 wt.% MCC loading and 3.25 with 5 wt.% BC loading. Besides, the presence of MCC and BC in the composite films led to an improvement in thermal properties, and mechanical properties in terms of Young's modulus and tensile strength with no dimensional changes at 110 °C due to the excellent thermal, and mechanical properties of cellulose structure.

บทคัดย่อ

ปริญญา ฆานะจารี : फिल्मของวัสดุเชิงประกอบของเซลลูโลสและพอลิไวนิลิดีนฟลูออไรด์โดยวิธีการผสมร้อน (Paranya Chanajaree: Dielectric and Piezoelectric Behaviors of Cellulose/ PVDF Composite Film Prepared By Melt Mixing Method) อ.ที่ปรึกษา : ศศ. ดร. หทัยกานต์ มนัสปิยะ 115 หน้า

พอลิไวนิลิดีนฟลูออไรด์และโคพอลิเมอร์เป็นพลาสติกเชิงเพียโซอิเล็กทริกที่มีความสามารถในการแปลงพลังงานกลเป็นพลังงานไฟฟ้าและในทางกลับกัน สามารถแปลงจากพลังงานไฟฟ้าเป็นพลังงานกล จึงถูกนำไปประยุกต์ใช้อย่างกว้างขวางในลักษณะของ ตัวกระตุ้นและตัวรับรู้ งานวิจัยนี้ได้พัฒนาฟิล์มเพียโซอิเล็กทริกแบบยืดหยุ่นสำหรับการนำไปใช้งานทางด้านจอสัมผัสแบบกอด ถูกเตรียมจากพอลิเมอร์ผสมระหว่างเซลลูโลสและพอลิไวนิลิดีนฟลูออไรด์โคเฮกซะฟลูออโรโพรพิลีน งานวิจัยนี้มุ่งเน้นที่จะศึกษา ผลของเซลลูโลส ในฐานะที่เป็นสารตัวเติมเพื่อพัฒนาการเรียงตัวของจุลภาคที่มีลักษณะเป็นช่องทางไฟฟ้า จากแหล่งที่มาที่แตกต่างกันสองชนิด คือ ไมโครคริสตัลลินเซลลูโลสจากการย่อยสลายเส้นใยเหลือทิ้งจากกากอ้อย ในสัดส่วน 1 ถึง 20 เปอร์เซ็นต์โดยน้ำหนัก และแบคทีเรียเซลลูโลสจากการย่อยสลายวัชพืชมะพร้าว โดยมีการศึกษาผลของสัดส่วนของแบคทีเรียเซลลูโลส ในสัดส่วน 1 ถึง 5 เปอร์เซ็นต์โดยน้ำหนัก พอลิเมอร์ผสมในอัตราส่วนต่างๆ ถูกเตรียมขึ้นโดยวิธีการผสมร้อนในเครื่องผสมแบบสกรูคู่ ตามด้วยการขึ้นรูปฟิล์มด้วยการหล่อ ผลการวิจัยพบว่าผลึกที่เกิดขึ้นของพอลิไวนิลิดีนฟลูออไรด์โคเฮกซะฟลูออโรโพรพิลีนมีปริมาณผลึกแบบเบตตามากขึ้นเมื่อปริมาณของเซลลูโลสมากขึ้น ส่งผลต่อการเพิ่มขึ้นคุณสมบัติไดอิเล็กทริกซึ่งมีความสัมพันธ์กับคุณสมบัติเชิงเพียโซอิเล็กทริกจาก 2.00 เป็น 3.75 จากการเติมไมโครคริสตัลลินเซลลูโลสอัตราส่วน 10 เปอร์เซ็นต์โดยน้ำหนัก และ 3.25 จากการเติมแบคทีเรียเซลลูโลสอัตราส่วน 10 เปอร์เซ็นต์โดยน้ำหนัก นอกจากนี้คุณสมบัติทางความร้อนและเชิงกลของฟิล์มมีค่าสูงขึ้นจากการเติมเซลลูโลสในอัตราส่วนมากขึ้น และยังพบว่าเมื่อเติมเซลลูโลสทำให้ไม่มีการหดของฟิล์มที่อุณหภูมิ 110 องศาเซลเซียส

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