

**SILVER NANOPARTICLES FILLED IN BACTERIAL
CELLULOSE/POLY(VINYLDENE FLUORIDE) NANOCOMPOSITE
FILMS FOR TOUCHSCREEN APPLICATIONS**

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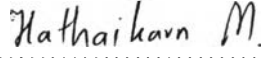
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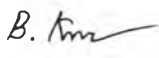

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ABSTRACT

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Ekasit Phakdeeparaphan: Silver Nanoparticles Filled in Bacterial Cellulose /Poly(Vinylidene Fluoride) Nanocomposite Films for Touchscreen Applications.

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Keywords: Poly(vinylidene fluoride)/ Bacterial cellulose/ Silver nanoparticles/ Nanocomposite/ Dielectric properties/ Piezoelectric properties

Flexible piezoelectric films of bacterial cellulose(BC)/poly(vinylidene fluoride) (PVDF) were successfully prepared via solution casting and hot compression method. The various weight percentage of BC (2.5-15 wt%) was incorporated into PVDF matrix using dimethylformamide (DMF) as a solvent and dispersing liquid to study the basis of piezoelectric touch sensor. The combination of β crystalline phase and α crystalline phase of BC/PVDF blend films were presence with the higher amount of β crystalline phase. According to the application of touchscreen, BC2.5PVDF97.5 was selected as a based nanocomposite to develop further due to its highest percentage of transmission at the wavelength range of 400 nm – 750 nm which is the range of visible light compared with the other blends. In order to achieve high dielectric properties for piezoelectric touch sensor, silver nanoparticles (AgNP) was introduced to enhance the dielectric constant of the blend. AgNP has high ability to create an interaction with hydroxyl groups in BC and fluorine atoms in PVDF chains which can generate the dipolar polarization. The highest dielectric constant was observed in 0.5 wt% of AgNP in nanocomposite film which can yield to higher dielectric constant about 4 times compare with blend film. The incorporated of BC exhibited an improving of thermal stability and dynamic mechanical properties, but decreasing the transmittance percentage of visible light. In contrast, AgNP may agglomerate which can obstruct the light not to pass through the nanocomposite easily, resulted to the worse transmittance percentage of visible light.

บทคัดย่อ

เอกศิษฐ์ ภักดีภัทรพันธุ์ : ฟิล์มของวัสดุเชิงประกอบระดับนาโนของแบคทีเรียเซลลูโลส และพอลิไวนิลิดีนฟลูออไรด์ที่ถูกเติมด้วยอนุภาคเงินระดับนาโน สำหรับการนำไปใช้งานทางด้านจอสัมผัส (Silver Nanoparticles Filled in Bacterial Cellulose /Poly(Vinylidene Fluoride) Nanocomposite Films for Touchscreen Applications) ๑.ที่ปรึกษา : ผศ.ดร. หทัยกานต์ มนต์ปิยะ และ ดร.สรุต อำนาจโยธิน 113 หน้า

ฟิล์ม โพลีไคโอเล็กทริกแบบยืดหยุ่นถูกเตรียมจากพอลิเมอร์ผสมระหว่างแบคทีเรียเซลลูโลสและพอลิไวนิลิดีนฟลูออไรด์โดยผ่านกระบวนการขึ้นรูปด้วยสารละลายและกระบวนการอัดด้วยความร้อน วัสดุผสมถูกเตรียมโดยใช้สารละลายไดเมทิลฟอร์มาไมด์สำหรับทำหน้าที่เป็นตัวทำละลายและช่วยให้แบคทีเรียเซลลูโลสกระจายอยู่ในเนื้อพอลิไวนิลิดีนฟลูออไรด์ได้เป็นอย่างดี โดยมีการศึกษาผลของสัดส่วนของแบคทีเรียเซลลูโลสตั้งแต่ - 2.5 จนถึง 15 เปอร์เซ็นต์โดยมวล สำหรับนำไปใช้งานด้านจอสัมผัส ซึ่งพบว่าผลึกที่เกิดขึ้นของพอลิไวนิลิดีนฟลูออไรด์เป็นผลึกแบบผสม โดยลักษณะของผลึกส่วนใหญ่จะเป็นผลึกแบบเบตา มากกว่าอัลฟา เมื่อคำนึงถึงการนำไปใช้งานทางด้านจอสัมผัส วัสดุผสมของแบคทีเรียเซลลูโลสและพอลิไวนิลิดีนฟลูออไรด์ที่อัตราส่วน 2.5:97.5 โดยมวลถูกเลือกมาใช้ในการเตรียมฟิล์มคอมโพสิตต่อไปเนื่องจากมีค่าความสามารถในการให้แสงผ่านได้สูงที่สุดเมื่อเทียบกับวัสดุผสมที่อัตราส่วนอื่นๆ เพื่อที่จะทำให้อายุการใช้งานของวัสดุโพลิเมอร์ที่นำมาใช้ทางด้านจอสัมผัสแบบกด อนุภาคเงินขนาดนาโนจึงถูกเติมเพื่อช่วยในการเพิ่มค่าคงที่ไดอิเล็กทริกของวัสดุผสม อนุภาคเงินขนาดนาโนสามารถที่จะเกิดปฏิกิริยากับหมู่ไฮดรอกซิลในแบคทีเรียเซลลูโลสและอะตอมของฟลูออรีนในสายโซ่ของพอลิไวนิลิดีนฟลูออไรด์ซึ่งทำให้เกิดโพลาไรเซชันแบบไดโพลาร์เพิ่มขึ้นได้ วัสดุคอมโพสิตมีค่าคงที่ไดอิเล็กทริกสูงที่สุดเมื่อมีการเติมอนุภาคเงินขนาดนาโนลงไปประมาณ 0.5 เปอร์เซ็นต์โดยมวล ซึ่งให้ค่าคงที่ไดอิเล็กทริกที่สูงกว่าฟิล์มผสมของแบคทีเรียเซลลูโลสและพอลิไวนิลิดีนฟลูออไรด์ถึง 4 เท่า การเติมแบคทีเรียเซลลูโลสสามารถเพิ่มความสามารถในการทนทานต่อความร้อนและสมบัติเชิงกลพลวัต แต่จะทำให้ความสามารถในการให้แสงผ่านลดลงด้วย นอกจากนี้การเติมอนุภาคเงินขนาดนาโนก็ทำให้ความสามารถในการให้แสงผ่านลดลงไปอีกเนื่องจากอนุภาคเงินขนาดนาโนนี้จะเกิดการรวมตัวเป็นกลุ่มก้อน ซึ่งจะช่วยให้แสงส่องผ่านได้ยากขึ้นนั่นเอง

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