

**OPTICAL FILMS BASED ON POLY(*P*-PHENYLENE VINYLENE) (PPV),
PROTEIN EXTRACTED FROM THE SCALES OF SEABASS, AND
THEIR NANOCOMPOSITES**

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ABSTRACT

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Keywords : Poly(*p*-phenylene vinylene)/ Nanocomposites/ Light-emitting diodes/ Montmorillonite/ Color tunability/ Environmental stability

Nanocomposites of poly(*p*-phenylene vinylene) (PPV) and protein extracted from the scales of seabass were studied. The natural sodium-montmorillonite was cation exchanged with bis(hydrogenated tallowalkyl) dimethyl quaternary ammonium chloride. These polymer/layered silicate nanocomposites were synthesized and consisted of different organically-modified clays, proven by TGA, WAXD, FTIR, and TEM. Barrier properties and color tunability improved with increasing organophilic clay content. The rate of photoluminescence decay in polymer-clay nanocomposites drastically reduced compared to that of pristine polymer. Organic light-emitting diodes based on PPV, protein and their nanocomposites fabricated by spin-coating have demonstrated good operating stability. The results showed important implications for enhanced lifetime of polymer-clay nanocomposites based optoelectronic devices.

บทคัดย่อ

ดวงพร สารระมาศ : ไดโอดเปล่งแสงที่ทำจากสารพอลิพาราฟีนิลีนไวนิลีน, สารเรืองแสงสกัดจากเกล็ดปลากระพงขาวและพอลิเมอร์นาโนคอมพอสิต (Optical Films Based on Poly (*p*-phenylene vinylene) (PPV), Protein Extracted from the Scales of Seabass, and their Nanocomposites) อ. ที่ปรึกษา: ผศ.ดร. รัตนาวรรณ มกรพันธุ์ และ รศ.ดร. เดวิด ซี มาร์ติน 87 หน้า ISBN 974-17-2317-2

อายุการใช้งานของไดโอดเปล่งแสงที่ทำจากพอลิพาราฟีนิลีนไวนิลีนและสารเรืองแสงซึ่งสกัดจากเกล็ดปลากระพงขาวได้ถูกพัฒนาให้มีประสิทธิภาพขึ้นโดยการผสมอนุภาคขนาดเล็กมากในหน่วยนาโนเมตรเข้าไปในสารตั้งต้น ดินซึ่งเป็นสารประกอบซิลิเกตได้ถูกปรับสภาพให้มีคุณสมบัติความเป็นสารอินทรีย์มากขึ้นโดยอาศัยสารลดแรงตึงผิว พอลิเมอร์นาโนคอมพอสิตเหล่านี้ได้ถูกสังเคราะห์ขึ้นมาโดยใช้ปริมาณของดินที่อัตราส่วนแตกต่างกันและสามารถตรวจสอบได้ด้วยเทคนิค TGA, WAXD, FTIR และ TEM จากการทดลองพบว่าสารนาโนคอมพอสิตมีคุณสมบัติความต้านทานต่อความชื้นและก๊าซรวมถึงความสามารถในการเปล่งแสงที่ความถี่ต่างกันก่อให้เกิดความหลากหลายของสีที่เปล่งออกมา นอกจากนี้พบว่าเมื่อปริมาณของดินเพิ่มมากขึ้น สารพอลิเมอร์นาโนคอมพอสิตยังสามารถลดอัตราการเสื่อมสภาพของแสงที่เปล่งออกมาได้ดีกว่าพอลิเมอร์บริสุทธิ์ ไดโอดเปล่งแสงที่ถูกสร้างขึ้นจากพอลิเมอร์นาโนคอมพอสิตส่งผลให้มีประสิทธิภาพในการใช้งานมากขึ้น จากผลการทดลองทั้งหมดที่กล่าวมาสามารถสรุปได้ว่าพอลิเมอร์นาโนคอมพอสิตเป็นอีกทางเลือกหนึ่งที่สามารถนำไปใช้ประโยชน์เพื่อพัฒนาประสิทธิภาพอายุการใช้งานของเครื่องมือทางเทคโนโลยีอิเล็กทรอนิกส์ต่อไป

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ABBREVIATIONS

| | | |
|--------|---|---|
| CEC | = | Cation Exchange Capacity |
| EL | = | Electroluminescence |
| HOMO | = | Highest Occupied Molecular Orbital |
| I | = | Current |
| ITO | = | Indium Tin Oxide |
| LUMO | = | Lowest Unoccupied Molecular Orbital |
| LED | = | Light-Emitting Diode |
| Meq | = | Milliequivalent |
| MMT | = | Montmorillonite |
| Na-MMT | = | Sodium Montmorillonite |
| OH-MMT | = | Bis(hydrogenated tallowalkyl) dimethyl quaternary ammonium chloride-montmorillonite |
| PL | = | Photoluminescence |
| PPV | = | Poly (<i>p</i> -phenylene vinylene) |
| V | = | Voltage |