

**ELECTRICAL CONDUCTIVITY RESPONSE OF
POLY(P-PHENYLENE VINYLENE)/ZEOLITE COMPOSITES EXPOSED
TO FLAMMABLE SOLVENT**

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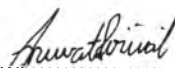


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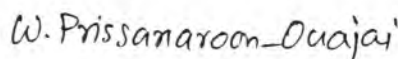
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ABSTRACT

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The development of gas sensing materials with selective and sensitive properties for volatile organic compounds (VOCs) detection had been of interest due to the industrial process pollution. One of possible sensor operating principles is the electrical conductivity response of the sensing material towards VOCs. In this work, Dope poly(p-phenylene vinylene) or dPPV was mixed with the three zeolite types: zeolite Y (NaY); mordenite (NaMOR); and 5A LTA (Na5A) to detect acetone, MEK, MIBK, methanol, and n-heptane at the vapor concentration of 30000 ppm. The effects of cation type, cation concentration, zeolite type, vapor concentration, dPPV, and cyclic interval were investigated. 80CuNaY showed the highest electrical conductivity sensitivity under acetone exposure at 30000 ppm in N₂ relative to other cation types (Ni²⁺, Fe²⁺, K⁺, Na⁺, Ca²⁺, Mg²⁺, and H⁺). Furthermore, with increasing cation content in NaY, the electrical conductivity sensitivity towards acetone vapor increased, especially at 80% ion exchanged. 10% v/v of dPPV was mixed into 80CuNaY and 80CuNaMOR matrices and they were exposed to acetone, methanol, and n-heptane. dPPV/[90]80CuNaY could respond well in the polar solvents (acetone and methanol) with the minimum vapor concentrations of 5 ppm for acetone and 2 ppm for methanol while dPPV/[90]80CuNaMOR showed the lowest detection limit of 5 ppm in a non-polar vapor (n-heptane). Overall, dPPV enhanced the electrical conductivity sensitivity of 80CuNaY and 80CuNaMOR by an order magnitude. For the cyclic interval, the electrical conductivity response decreased with increasing number of cyclic intervals towards acetone vapor due to the irreversible interaction as evidenced by FTIR and AFM techniques.

บทคัดย่อ

จิราวัฒน์ กมลสวัสดิ์ : การตอบสนองทางไฟฟ้าของสารคอมพอสิตระหว่างพอลิฟีนิลลิโวนิลลินและซีโอไลต์เมื่อสัมผัสกับไอระเหยของตัวทำละลายติดไฟได้ Electrical Conductivity Response of Poly(p-Phenylene Vinylene)/Zeolite Composites Exposed to Flammable Solvents อ. ที่ปรึกษา : ศ.ดร. อนุวัฒน์ ศิริวัฒน์ 169 หน้า

ในปัจจุบันภาคอุตสาหกรรมมีการนำวัสดุที่ใช้ในการตรวจจับไอระเหยสารเคมีที่มีความเป็นพิษอย่างแพร่หลายแต่ยังมีส่วนเสียในเรื่องของการเลือกจับไอระเหยของสารเคมี ดังนั้นในงานวิจัยนี้ได้พัฒนาวัสดุตรวจจับโดยใช้ พอลิฟีนิลลิน โวนิลลินผสมกับซีโอไลต์ชนิดต่างๆ และศึกษาผลของแก๊สไอออนที่ต่างกัน ปริมาณแก๊สไอออนในซีโอไลต์ ปริมาณของพอลิเมอร์นำไฟฟ้า ชนิดของไอระเหยของสารเคมี (อะซีโตน, เมทานอล, คีโตน, เมทิลไอโซบิลทิล คีโตน, เมทานอล และนอร์มัลเฮกเซน) และจำนวนรอบของการตอบสนองต่อไอระเหยสารเคมีโดยเลือกใช้เทคนิคการวัดการเปลี่ยนแปลงทางไฟฟ้าของวัสดุตรวจจับเมื่อมีการสัมผัสกับไอระเหยของสารเคมี โดยเมื่อนำซีโอไลต์ชนิดวายเป็นแก๊สไอออนกับคอปเปอร์แล้วตอบสนองต่อไอระเหยของ อะซีโตนได้สูงสุดเมื่อเทียบกับซีโอไลต์ชนิดวายเป็นแก๊สไอออนกับนิกเกิล เฟอร์ริก โซเดียม แอมโมเนียม แคลเซียม แมกนีเซียมและไฮโดรเจนตามลำดับ ที่ความเข้มข้นไอระเหยอะซีโตนที่ 30000 พีพีเอ็ม และเมื่อนำได้ปพอลิฟีนิลลิน โวนิลลินหรือ ได้ปพีวีผสมลงใน คอปเปอร์โซเดียม วาย คอปเปอร์โซเดียมมอร์เดอร์ไนต์ และคอปเปอร์โซเดียมเอ ที่ 10% โดยปริมาตรของ ได้ปพีวี และตรวจวัดการตอบสนองต่อไอระเหยของอะซีโตน เมทานอลและนอร์มัลเฮกเซน พบว่าคอปเปอร์โซเดียมวายเป็นแก๊สไอออนจับไอระเหยของอะซีโตนและเมทานอลได้แต่ไม่สามารถจับไอระเหยของนอร์มัลเฮกเซนได้ ในขณะที่คอปเปอร์โซเดียมมอร์เดอร์ไนต์สามารถจับไอระเหยของนอร์มัลเฮกเซน ดังนั้นซีโอไลต์จะช่วยให้ได้ปพีวีคัดเลือกการจับสารมากขึ้นและได้ปพีวีจะช่วยให้ซีโอไลต์แสดงสัญญาณการตอบสนองที่ดีขึ้น เมื่อศึกษาผลของจำนวนรอบการตอบสนองพบว่าเมื่อเพิ่มจำนวนรอบการตอบสนองค่าการตอบสนองต่อไอระเหยของสารเคมีจะลดลงเนื่องจากยังมีปฏิกิริยาหลงเหลืออยู่และเรื่องของการความสามารถในการตรวจจับไอระเหยของสารเคมีที่มีความเป็นขั้วต่างกัน

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