

ต้นฉบับ หน้าขาดหาย

**DEVELOPMENT OF POLYANILINE/ZEOLITE A COMPOSITE AS A  
CARBONMONOXIDE SENSOR**

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## บทคัดย่อ

จินตนา เชื้อประดิษฐ์: การพัฒนาสารประกอบพอลิอะนิลีนกับซีโอไลต์เอสำหรับตรวจจับก๊าซคาร์บอนมอนอกไซด์ (Development of Polyaniline/Zeolite A Composite as a Carbonmonoxide Sensor) อ.ที่ปรึกษา: ศ. ดร. โจอห์นเนส ดับบลิว ชเวงค์และรศ.ดร.อนุวัฒน์ ศิริวัฒน์ 123 หน้า ISBN 974-03-1610-7

พอลิอะนิลีนเป็นพอลิเมอร์นำไฟฟ้าที่มีการใช้งานอย่างแพร่หลายเนื่องจากคุณสมบัติที่ดี ตัวอย่างเช่นง่ายต่อการสังเคราะห์ แต่เมื่อนำพอลิอะนิลีนมาใช้เป็นตัวตรวจสอบก๊าซพบว่าพอลิอะนิลีนมีความเฉพาะต่อการตรวจสอบชนิดของก๊าซต่ำ ซีโอไลต์ชนิดเอเป็นตัวดูดซับที่มีโครงสร้างเป็นรูพรุนขนาดเล็กระดับไมครอนที่ซึ่งมีคุณสมบัติในการเลือกดูดซับต่อชนิดของสารที่ถูกดูดซับบนพื้นฐานของความแตกต่างในระดับโครงสร้างที่เป็นรูพรุนและความเป็นขั้ว ซีโอไลต์เอ 3 ชนิดถูกเลือกมาผสมกับพอลิอะนิลีน เพื่อทำสารประกอบพอลิอะนิลีนซีโอไลต์เอ โดยศึกษาผลกระทบที่เกิดจากชนิดของกรดที่เป็นตัวได้ป ความเข้มข้นของตัวได้ป ชนิดของซีโอไลต์เอและปริมาณของซีโอไลต์เอในสารประกอบพอลิอะนิลีนซีโอไลต์เอ ในการตอบสนองทางไฟฟ้าต่อก๊าซคาร์บอนมอนอกไซด์ของสารประกอบดังกล่าว จากการศึกษพบว่ากรดไฮโดรคลอริกให้ระดับการได้ปสูงกว่ากรดมาเลอิกที่อัตราส่วนโดยมวลระหว่างกรดกับพอลิอะนิลีนต่ำกว่า 2 เท่า และการนำไฟฟ้าของพอลิอะนิลีนเพิ่มขึ้นอย่างรวดเร็วตามระดับการได้ปที่เพิ่มขึ้น เมื่ออัตราส่วนโดยมวลของกรดต่อพอลิอะนิลีนสูงขึ้น เปอร์เซนต์ได้ปของพอลิอะนิลีนเข้าสู่สมดุลที่ 100% ซึ่งให้ค่าการนำไฟฟ้าประมาณ 4 ซีเมนส์ต่อเซนติเมตร ความไวในการตอบสนองของพอลิอะนิลีนต่อความเข้มข้นของก๊าซคาร์บอนมอนอกไซด์มีความสัมพันธ์กันตามสมการยกกำลัง ที่ซึ่งพอลิอะนิลีนได้ปด้วยกรดมาเลอิกที่อัตราส่วนโดยมวลเท่ากับ 10 เหมาะสำหรับการใช้ตรวจสอบปริมาณก๊าซคาร์บอนมอนอกไซด์ เพราะแสดงค่าการนำไฟฟ้าและความไวในการตอบสนองสูง สำหรับการตอบสนองต่อก๊าซคาร์บอนมอนอกไซด์ของสารประกอบพอลิอะนิลีนซีโอไลต์เอนั้นพบว่าสารประกอบพอลิอะนิลีนซีโอไลต์เอมีค่าความไวในการตอบสนองลดลงเมื่อเปรียบเทียบกับพอลิอะนิลีนทั้งนี้เพราะการลดลงของปริมาณพอลิอะนิลีน

**ABSTRACT**

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Polyaniline (PANI) is one of the most promising conductive polymers. Despite all the advantages of polyaniline, such as its ease of synthesis, polyaniline has low selectivity when it is used as a gas sensor. Three types of zeolite LTA: KA, NaA and CaA, were chosen based on different effective pore size and polarity, and mixed with maleic acid MA-doped PANI (PANI-MA) in a dry mixing process to produce PANI/Zeolite A. The effects of acid dopant type, dopant concentration, zeolite type and zeolite A content on electrical conductivity responses when exposed to CO at room temperature are studied. At acid-aniline monomer mole ratio  $N_A/N_{EB}$  less than 2.0, HCl-doped polyaniline had a higher doping level than MA-doped polyaniline where the electrical conductivity increased dramatically with doping level. At acid-aniline monomer mole ratios greater 2.0, the doping levels and  $\sigma$  reached equilibrium values of  $\sim 100\%$  and 4 S/cm, respectively. The CO sensitivity of the polyaniline sensor was found to obey the power law  $\Delta\sigma = a [\text{CO}]^b$ ,  $b \sim 0.35-0.75$ . PANI-10.0MA is suitable for use as a CO sensor because it has a high conductivity and sensitivity. The PANI-10MA/Zeolite A sensor had lower CO gas sensitivity than pure PANI-10MA. All zeolites A type reduced the CO gas sensitivity of the PANI-10MA sensor because of the decrease of PANI-10MA free volume.

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