

**SYNTHESIS OF  $MgAl_2O_4$  SPINEL AND ITS APPLICATION AS A  
HUMIDITY SENSING ELEMENT**

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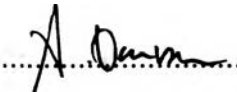
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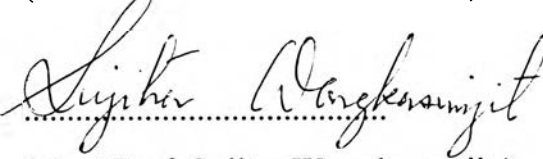
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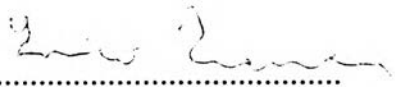
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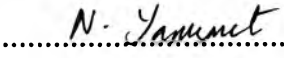
  
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## ABSTRACT

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KEY WORD : SPINEL / HUMIDITY SENSOR

APIRAT LAOBUTHEE : SYNTHESIS OF  $\text{MgAl}_2\text{O}_4$  SPINEL  
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$\text{MgAl}_2\text{O}_4$  spinel powder can be prepared via the oxide one pot synthesis (OOPS) process, solid-state reactions, and the reaction between alumatrane and magnesium methoxide [ $\text{Mg}(\text{OMe})_2$ ]. Spinel preparation via the OOPS process and the reaction between alumatrane and  $\text{Mg}(\text{OMe})_2$  offer more advantages compared to the solid-state method, such as shorter process times, lower process temperatures, high homogeneity and higher purity products.

The spinel obtained from the OOPS process by heating the precursor to  $1100^\circ\text{C}$  for 2 h was a ceramic oxide of use as a humidity-sensing material, prepared in the bulk form or as porous pellets. The various products were characterized by SEM. Pellets electrical responses were measured using impedance spectroscopy in the frequency range from  $10^{-2}$  to  $10^5$  Hz at 2-90% relative humidity (RH) levels. The powder exhibited good humidity sensitivity and good linearity in the relationship between humidity and impedance. Reproducibility in the 2-90% RH range was similar to that of powders prepared by other methods, such as co-precipitation or solid-state reactions.

## บทคัดย่อ

อภิรัตน์ เลาห์บุตรี : การสังเคราะห์แมกนีเซียมออกไซด์สปีเนล และการประยุกต์ในการใช้เป็นวัสดุสำหรับหัววัดความชื้น [Synthesis of  $MgAl_2O_4$  Spinel and Its Application as a Humidity Sensing Element] อ. ที่ปรึกษา : รศ. ริชาร์ด เอ็ม เลน (Assoc. Prof. Richard M. Laine) ผศ.ดร. สุจิตรา วงศ์เกษมจิตต์ และ ศ. เอ็นริโก ทราเวิซาร์ (Prof. Enrico Traversa) 55 หน้า ISBN 974-636-064-7

การสังเคราะห์ผงเซรามิกแมกนีเซียมออกไซด์สปีเนล สามารถเตรียมได้โดยผ่านกรรมวิธีที่เรียกว่า “The Oxide One Pot Synthesis (OOPS) Process” ปฏิกริยาระหว่างของแข็งกับของแข็ง และ ปฏิกริยาระหว่างอลูมาเทรอนกับแมกนีเซียมเมทอกไซด์ การเตรียมสปีเนลโดยกรรมวิธี OOPS และ ปฏิกริยาระหว่างอลูมาเทรอนกับแมกนีเซียมเมทอกไซด์ จะให้ผลดีกว่าการเตรียมด้วยปฏิกริยาระหว่างของแข็งกับของแข็ง คือ เวลาในการทำปฏิกริยาสั้นกว่า สามารถเตรียมได้ที่อุณหภูมิต่ำกว่า และได้ผลผลิตที่มีขนาดสม่ำเสมอรวมทั้งให้ความบริสุทธิ์ที่สูงกว่า

ผงสปีเนลที่เตรียมได้เป็นสารจำพวกเซรามิกที่มีรูพรุน และเหมาะที่จะนำไปใช้เป็นวัสดุสำหรับหัววัดความชื้น ซึ่งในเบื้องต้นได้ศึกษาในรูปแบบของเม็ดผลึก โดยตรวจสอบโครงสร้างของสารที่ได้จาก SEM และวัดสมบัติด้านการนำไฟฟ้าโดยใช้เทคนิคอิมพีแดนซ์สเปคโตรสโคปี ในช่วงความถี่จาก  $10^{-2}$  ถึง  $10^5$  เฮิรต ที่ระดับความชื้นตั้งแต่ 2 ถึง 90% โดยสปีเนลที่เตรียมได้นี้ แสดงสมบัติที่ตอบสนองต่อความชื้นได้ดี และมีความสัมพันธ์เป็นเส้นตรงระหว่างความชื้นกับค่าอิมพีแดนซ์ ความเที่ยงตรงในการตอบสนองในระดับความชื้นระดับต่างๆ ให้ผลเช่นเดียวกับผงเซรามิกที่เตรียมได้จากวิธีอื่นๆ เช่น การตกตะกอน หรือ ปฏิกริยาระหว่างของแข็งกับของแข็ง

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