

**OXIDATIVE BROMINATION OF METHANE BY BARIUM OXIDE OR  
TUNGSTEN OXIDE ON SILICA CATALYSTS: EFFECT OF CATALYSTS  
PREPARATION**

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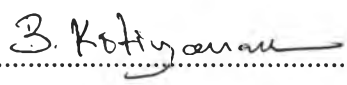
**Thesis Title:** Oxidative Bromination of Methane by Barium Oxide or Tungsten Oxide on Silica Catalysts: Effect of Catalysts Preparation  
**By:** Korn Somjit  
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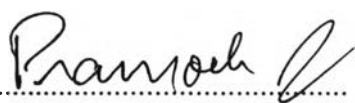
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## ABSTRACT

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Oxidative bromination of methane (OBM) has been proposed for methane activation. In this work, methane was brominated by HBr/H<sub>2</sub>O solution with oxygen as an oxidizing agent to produce methyl bromide. Barium oxide or tungsten oxide on silica were chosen as the catalysts to improve the activity and selectivity of the reaction. The catalysts were prepared by 2 techniques, incipient wetness impregnation and sol-gel method. The effects of catalyst preparations on oxidative bromination of methane were investigated. The reaction was carried out in a fixed-bed continuous-flow reactor at atmospheric pressure. The catalysts were characterized by BET and XRD techniques. The results showed that, under the same condition (20 ml/min of CH<sub>4</sub>, 5 ml/min of O<sub>2</sub>, 5 ml/min of N<sub>2</sub>, 6.5 ml/h of 48 wt% HBr/H<sub>2</sub>O and temperature at 660 °C), the sol-gel catalysts exhibited higher methane conversion and methyl bromide selectivity than impregnated catalysts. The reason might be that metal oxides on sol-gel catalysts are smaller than those in impregnated catalysts.

## บทคัดย่อ

กรณี สมจิตร : ออกซิเดทีฟโบรมิเนชันของมีเทนโดยใช้ตัวเร่งปฏิกิริยาแบเรียมออกไซด์ หรือทังสเตนออกไซด์บนตัวรองรับซิลิกา : ผลของการเตรียมตัวเร่งปฏิกิริยา (Oxidative Bromination of Methane by Barium Oxide or Tungsten Oxide on Silica Catalysts: Effect of Catalysts Preparation) อาจารย์ที่ปรึกษา : ผศ. ดร. บุญยรัชต์ กิตยานันท์ 71 หน้า

ปฏิกิริยาออกซิเดทีฟโบรมิเนชันเป็นปฏิกิริยาสำหรับกระตุ้นความว่องไวของมีเทน ในงานวิจัยนี้มีเทนจะถูกโบรมิเนทโดยสารละลายกรดไฮโดรโบรมิกและมีออกซิเจนเป็นตัวกระตุ้นให้เกิดปฏิกิริยาออกซิเดชันเพื่อผลิตเมทิลโบรไมด์ โดยได้ใช้แบเรียมออกไซด์หรือทังสเตนออกไซด์ บนตัวรองรับซิลิกาเป็นตัวเร่งปฏิกิริยาเพื่อปรับปรุงการเลือกเกิดของเมทิลโบรไมด์ ซึ่งตัวเร่งปฏิกิริยาจะเตรียมด้วยวิธีที่แตกต่างกัน 2 วิธี คือ วิธีการเอิบซุ่ม และ วิธีการโซลเจล โดยผลของการเตรียมตัวเร่งต่อปฏิกิริยาออกซิเดทีฟโบรมิเนชันของมีเทนจะถูกศึกษา สารตั้งต้นทั้งหมดจะถูกป้อนเข้าสู่เตาปฏิกรณ์แบบต่อเนื่องและทำปฏิกิริยาที่ความดันบรรยากาศ ตัวเร่งปฏิกิริยาจะถูกวิเคราะห์ด้วยเทคนิคต่างๆ เพื่อหาพื้นที่ผิวและความเป็นผลึก จากผลการทดลองพบว่าที่สภาวะการทดลองเดียวกัน (20 มิลลิลิตรต่อนาทิจของมีเทน, 5 มิลลิลิตรต่อนาทิจของออกซิเจน, 5 มิลลิลิตรต่อนาทิจของไนโตรเจน และ 6.5 มิลลิลิตรต่อชั่วโมงของกรดไฮโดรโบรมิก และ อุณหภูมิการทำปฏิกิริยาเท่ากับ 660 องศาเซลเซียส) ตัวเร่งปฏิกิริยาที่เตรียมด้วยวิธีโซลเจลจะให้ค่าการแปรผันของมีเทนและค่าการเลือกเกิดของเมทิลโบรไมด์สูงกว่าตัวเร่งปฏิกิริยาที่เตรียมจากวิธีการเอิบซุ่ม ซึ่งอาจจะเป็นเหตุผลมาจากโลหะออกไซด์ของตัวเร่งปฏิกิริยาแบบโซลเจลมีขนาดเล็กกว่าตัวเร่งปฏิกิริยาแบบเอิบซุ่ม

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