

**NON – OXIDATIVE CONVERSION OF METHANE INTO OLEFINS USING  
BIMETTALLIC Ni - Mo/HZSM-5 CATALYSTS**

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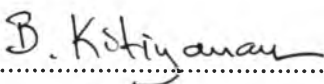
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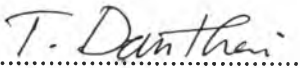
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## ABSTRACT

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The direct route under non-oxidative conditions enables the intermediate syngas step to be suspended from processes that convert methane into olefins as well as prevents the carbon dioxide formation. The performance of bimetallic Ni-Mo supported on HZSM-5 (Si/Al = 25) has been studied for non-oxidative conversion of methane into olefins. The catalysts were prepared by polyol mediated process with the different loading of nickel (0.5 – 3 wt%) and molybdenum (3 wt%). They were tested for the reaction using a continuous down flow fixed-bed reactor under non-oxidative conditions at atmospheric pressure, GHSV of 1,500 ml/g/h. At the given condition, the effects of nickel loading, reaction temperature, and methane feed concentration were studied. From the result, the increasing of Ni content from 0.5 to 3 wt% increased the ethylene selectivity and aromatics selectivity decreased especially benzene and toluene. However, the 3%Ni/HZSM-5 provided the 100 % selectivity of ethylene. It can be suggest Ni would play an important role in enhancing the ethylene formation and obstructed the aromatization of ethylene. However, coke formation would prevail resulting in the deactivation of catalysts at a longer TOS. Furthermore, the effect of reaction temperature and methane feed concentration play the important roles for this reaction by improve favorable thermodynamics of reaction and enhance the methane conversion and ethylene selectivity.

## บทคัดย่อ

จุฑาทิพย์ เทียงตรง : การสังเคราะห์โอเลฟินส์จากมีเทนภายใต้สภาวะไร้ออกซิเจน โดยใช้ตัวเร่งปฏิกิริยา Ni-Mo/HZSM-5 (Non-Oxidative Conversion of Methane into Olefins Using Bimetallic Ni-Mo/HZSM-5 Catalysts) อ. ที่ปรึกษา: รศ. ดร. ชีรศักดิ์ ฤกษ์สมบูรณ์ 70 หน้า

กระบวนการสังเคราะห์โอเลฟินส์จากมีเทนโดยตรงในสภาวะไร้ออกซิเจน เพื่อหลีกเลี่ยงก๊าซสังเคราะห์ซึ่งเกิดขึ้นระหว่างการเกิดปฏิกิริยาการเปลี่ยนแปลงมีเทนโดยอ้อมและป้องกันการเกิดก๊าซคาร์บอนไดออกไซด์จากปฏิกิริยาออกซิเดชัน ในงานวิจัยนี้จึงศึกษาประสิทธิภาพในการสังเคราะห์เอทิลีนจากมีเทนโดยตรงในสภาวะไร้ออกซิเจนบนตัวเร่งปฏิกิริยาร่วมกันของนิกเกิลและโมลิบดีนัม บนตัวรองรับ HZSM-5 (Si/Al = 25) ที่เตรียมโดยวิธีโพสิออล จากนั้นประสิทธิภาพของตัวเร่งปฏิกิริยาได้ถูกทดสอบภายใต้สภาวะไร้ออกซิเจนที่ความดันบรรยากาศ ที่อัตราการไหลของมีเทน GHSV 1,500 ml/g/h ผ่านปฏิกรณ์แบบเบดนิ่งภายใต้การศึกษาผลกระทบจากตัวแปรต่างๆ ได้แก่ ปริมาณนิกเกิลและโมลิบดีนัม อุณหภูมิในการทำปฏิกิริยาและความเข้มข้นของมีเทนขาเข้า จากผลการทดลองพบว่า การปรับปรุง 3%Mo/HZSM-5 โดยการปรับเปลี่ยนปริมาณนิกเกิลจำนวน 0.5 ถึง 3 เปอร์เซ็นต์โดยน้ำหนัก การเพิ่มปริมาณนิกเกิลส่งผลต่ออัตราการเลือกเกิดของเอทิลีนเพิ่มขึ้น ในทางตรงกันข้ามอัตราการเลือกเกิดของสารอะโรมาติกลดลง แต่อย่างไรก็ตาม 3%Ni/HZSM-5 มีอัตราการเลือกเกิดเอทิลีน 100 % จากผลการทดลองสามารถสรุปว่า นิกเกิลมีบทบาทต่อการเพิ่มการผลิตเอทิลีน และขัดขวางการเกิดสารประกอบอะโรมาติกจากเอทิลีน สำคัญยิ่งไปกว่านั้นผลของอุณหภูมิในการทำปฏิกิริยาและความเข้มข้นของมีเทนขาเข้า ยังช่วยเพิ่มอัตราการเปลี่ยนแปลงของมีเทนและอัตราการเลือกเกิดเอทิลีน โดยมีผลในการช่วยลดความเสถียรทางเทอร์โมไดนามิกของปฏิกิริยา แต่อย่างไรก็ตาม การเกิดโค้กทำให้ประสิทธิภาพของตัวเร่งปฏิกิริยาลดลงเมื่อทำปฏิกิริยาภายใต้สภาวะเป็นเวลานาน

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