

**HYDROGEN PRODUCTION FROM CARBON DIOXIDE REFORMING OF  
METHANE OVER Ni/KH ZEOLITE CATALYSTS**

Athiya Kaengsilalai

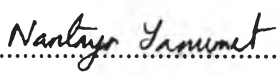
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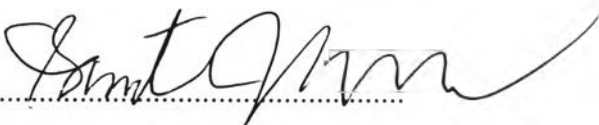
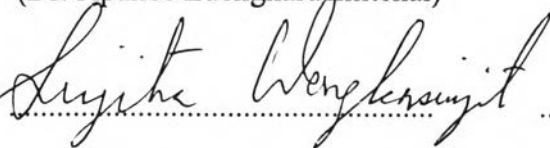
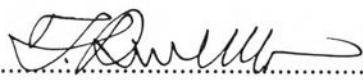
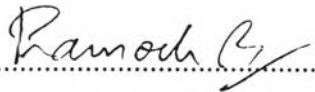
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**Thesis Advisors:** Dr. Apanee Luengnaruemitchai  
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## ABSTRACT

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Keywords: CO<sub>2</sub> Reforming/ KH Zeolite/ Nickel/ Sol-gel Process/ Hydrothermal Treatment/ Up-scaling

Hydrogen production from carbon dioxide reforming of methane is an attractive way to utilize CO<sub>2</sub>, a greenhouse gas by-product of many industrial processes. Using KH zeolite as a basic support investigated in this study was expected to overcome the catalyst deactivation problem by decreasing carbon deposition. The KH zeolites were prior synthesized via silatrane and alumatrane precursors using sol-gel process and hydrothermal microwave treatment. Eight percent of Ni was impregnated on the KH zeolites synthesized from different morphology and batch scales. Catalytic activity testings were performed at 700°C, atmospheric pressure, and at a CH<sub>4</sub>/CO<sub>2</sub> ratio of 1. The results showed that Ni supported on Dog-Bone and Flower-shape KH zeolites provided better activity than that of disordered KH zeolite due to the small amount of coke formation on catalyst surface. Up-scaling also affected the morphology of synthesized KH zeolite, but did not significantly affect the activities of the catalysts. Interestingly, stability of Ni/KH zeolite was much superior to those of Ni supported on alumina and Clinoptiolite catalysts.

## บทคัดย่อ

อทิญา แก่งศิลาชัย : การผลิตไฮโดรเจนจากปฏิกิริยารีฟอร์มมิ่งมีเทนด้วยก๊าซคาร์บอนไดออกไซด์บนตัวเร่งปฏิกิริยานิกเกิลที่มีซีโอไลต์ชนิดเคเอชเป็นตัวรองรับ (Hydrogen Production from Carbon Dioxide Reforming of Methane over Ni/KH Zeolite Catalysts) อ. ที่ปรึกษา : ดร.อาภาณี เหลืองนฤมิตชัย ผศ.ดร.ศิริรัตน์ จิตการคำ และ รศ.ดร.สุจิตรา วงศ์เกษมจิตต์ 51 หน้า ISBN 974-9651-82-0

การผลิตไฮโดรเจนจากปฏิกิริยารีฟอร์มมิ่งมีเทนด้วยก๊าซคาร์บอนไดออกไซด์นั้น เป็นทางเลือกหนึ่งที่สามารถนำก๊าซคาร์บอนไดออกไซด์ ซึ่งเป็นผลิตภัณฑ์พลอยได้จากอุตสาหกรรมอื่น ๆ และเป็นสาเหตุหลักของปรากฏการณ์เรือนกระจกมาใช้ประโยชน์ได้โดยตรง การนำซีโอไลต์ชนิดเคเอชซึ่งเป็นตัวรองรับชนิดเบสมาศึกษาในงานวิจัยนี้ เนื่องจากคาดว่าจะสามารถแก้ปัญหาเรื่องการเสื่อมสภาพของตัวเร่งปฏิกิริยาได้ โดยเฉพาะการชะลอการเกิดโค้กบนพื้นผิวของตัวเร่งปฏิกิริยา ซีโอไลต์ชนิดเคเอชสามารถสังเคราะห์ผ่านกระบวนการโซลเจล โดยมีโซลาเทรนและอะลูมาเทรนเป็นสารริเริ่ม จากนั้นนำนิกเกิลใส่ลงบนตัวรองรับซีโอไลต์ชนิดเคเอชที่สังเคราะห์ได้ด้วยเทคนิคการฝังตัวแบบเปียก โดยจะศึกษาถึงผลกระทบของรูปร่างลักษณะผลึกและการขยายขนาดการสังเคราะห์ที่มีผลต่อความสามารถในการเร่งปฏิกิริยา ซึ่งการทดลองจะทำภายใต้ความดันบรรยากาศ 700 องศาเซลเซียส อัตราส่วนระหว่างมีเทนกับคาร์บอนไดออกไซด์เท่ากับหนึ่ง จากการทดลองพบว่าตัวเร่งปฏิกิริยานิกเกิลบนตัวรองรับที่มีรูปร่างลักษณะผลึกแบบกระดูก และดอกไม้สามารถเร่งปฏิกิริยาได้ดีกว่าตัวเร่งปฏิกิริยานิกเกิลบนตัวรองรับที่มีรูปร่างลักษณะผลึกแบบไร้รูปแบบ แสดงว่าลักษณะรูปร่างของผลึกซีโอไลต์มีผลกระทบต่อความสามารถในการเร่งปฏิกิริยา สำหรับอิทธิพลของการขยายขนาดการสังเคราะห์ซีโอไลต์พบว่าไม่มีผลต่อความสามารถในการเร่งปฏิกิริยาของตัวเร่งปฏิกิริยา นอกจากนี้ตัวเร่งปฏิกิริยานิกเกิลบนตัวรองรับซีโอไลต์ชนิดเคเอชที่สังเคราะห์ได้นั้น ยังมีความสามารถในการทนต่อความร้อนได้สูงกว่าตัวเร่งปฏิกิริยานิกเกิลบนตัวรองรับอะลูมินาและคลินอพทิโอไลต์

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