

ระเบียบวิธีการสังเคราะห์ที่มีผลต่อตัวเร่งปฏิกิริยาโครเมียม-ไทเทเนียมซิลิกาไลต์-1

นางสาวเอมอร พรหมเพชร

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SYNTHESIS METHODOLOGY AFFECTING CHROMIUM-TITANIUM SILICALITE-1 CATALYST

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A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Engineering Program in Chemical Engineering

Department of Chemical Engineering

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เอมอร พรหมเพชร : ระเบียบวิธีการสังเคราะห์ที่มีผลต่อตัวเร่งปฏิกิริยาโครเมียม-ไทเทเนียม ซิลิกาไลต์-1 (SYNTHESIS METHODOLOGY AFFECTING CHROMIUM-TITANIUM SILICALITE-1 CATALYST) อ. ที่ปรึกษา: รศ.ดร.ชราธร มงคลศรี, 111 หน้า.

งานวิจัยนี้ ศึกษาระเบียบวิธีการสังเคราะห์(วิธีการเติมเกลือโครเมียม)ที่มีผลต่อการสังเคราะห์ตัวเร่งปฏิกิริยาโครเมียม-ไทเทเนียมซิลิกาไลต์-1 ด้วยวิธีไฮโดรเทอร์มัล และศึกษาผลของความแตกต่างของชนิดของเกลือโครเมียม ( $\text{Cr}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  และ  $\text{CrO}_3$ ) วิเคราะห์ตัวเร่งปฏิกิริยาที่สังเคราะห์ได้ด้วยเทคนิค XRF XRD BET SEM FT-IR ESR และ  $\text{NH}_3$ -TPD และทำการทดสอบความว่องไวของตัวเร่งปฏิกิริยาโดยใช้ปฏิกิริยาการออกซิไดซ์ 2-โพรพานอล ด้วยออกซิเจนในวัฏภาคแก๊สในเครื่องปฏิกรณ์แบบเบดนิ่งในช่วงอุณหภูมิ 100-500°C ที่ความดันบรรยากาศองค์ประกอบของสารป้อนมีความเข้มข้นของ 2-โพรพานอลร้อยละ 5 และออกซิเจนร้อยละ 8 โดยปริมาตร การศึกษาพบว่าวิธีการเติมเกลือโครเมียมและชนิดของเกลือโครเมียมมีผลต่อปริมาณของโครเมียมที่เข้าไปในโครงสร้างของ TS-1 ตัวเร่งปฏิกิริยาที่สังเคราะห์ได้มีรูปร่างแตกต่างกันแต่ผลึกยังคงมีโครงสร้างแบบ MFI การวิเคราะห์ด้วยเทคนิค ESR พบว่าตัวเร่งปฏิกิริยาที่สังเคราะห์ได้บางตัวมี  $\text{Cr}^{5+}$  ในรูปออกทระฮีดรอลอยู่นอกโครงสร้างของตัวเร่งปฏิกิริยา การวิเคราะห์ด้วย  $\text{NH}_3$ -TPD พบว่าตัวเร่งปฏิกิริยาที่สังเคราะห์ได้มีตำแหน่งที่เป็นกรดที่มีความแรงแตกต่างกันอยู่ 2 กลุ่มด้วยกัน คือในช่วงอุณหภูมิ 137-149°C และ 224-247°C ความว่องไวของตัวเร่งปฏิกิริยาไม่ขึ้นอยู่กับปริมาณของโครเมียมที่เข้าไป ดังนั้นความว่องไวของตัวเร่งปฏิกิริยาที่สังเคราะห์ได้ จึงคล้ายคลึงกับตัวเร่งปฏิกิริยา TS-1

ภาควิชา.....วิศวกรรมเคมี..... ลายมือชื่อนิสิต..... *เอมอร พรหมเพชร*.....  
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KEY WORD: CHROMIUM-TITANIUM SILICALITE-1, Cr-TS-1, TS-1

EM-ORN PHROMPHET: SYNTHESIS METHODOLOGY AFFECTING  
CHROMIUM-TITANIUM SILICALITE-1 CATALYST. THESIS

ADVISOR: ASSOC.PROF. THARATHON MONGKHONSI, Ph.D. 111 pp.

This research focuses on the synthesis methodology (i.e. the chromium salt addition method) affecting the chromium-titanium silicalite-1 catalyst synthesized by hydrothermal method. The effect of using different kinds of chromium salt (i.e.  $\text{Cr}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  and  $\text{CrO}_3$ ) is also investigated. All synthesized catalysts are characterized using various techniques consisting of XRF XRD BET SEM FT-IR ESR and  $\text{NH}_3$ -TPD. The catalytic behavior of the synthesized catalysts is tested by the gas phase oxidation of 2-propanol in a fixed bed reactor at the reaction temperature range 100-500 °C, atmospheric pressure. The composition of the feed is 5% 2-propanol, 8% oxygen by volume and balanced with argon. The results show that the chromium salt addition method and the kind of chromium salt affect the amount of chromium incorporated into TS-1 structure. Moreover, it is found that the synthesized catalysts have various shapes but their MFI structures are maintained. The ESR results indicate that some synthesized catalysts consist of  $\text{Cr}^{5+}$  bonded in octahedral form outside the framework structure. The  $\text{NH}_3$ -TPD results report that the synthesized catalysts have two different types of acid strength, the weaker one desorbs  $\text{NH}_3$  at 137-149°C and the stronger one desorbs  $\text{NH}_3$  at 224-247°C. The catalytic behavior does not depend on the amount of incorporated chromium. Therefore, the catalytic activities over all synthesized catalysts and over TS-1 are similar.

Department.....Chemical Engineering... Student's signature.....Em-orn Phromphet  
Field of study....Chemical Engineering... Advisor's signature.....*or ar or d*.....  
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Finally, the author would like to dedicate the achievement of this work to her parents, who have always been the source of her support and encouragement.

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