

**n-HEXANE AROMATIZATION TO BENZENE ON Pt/KL AND
PtYb/KL CATALYSTS PREPARED BY CVD METHOD**

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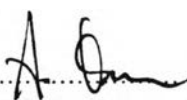
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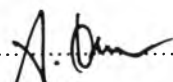
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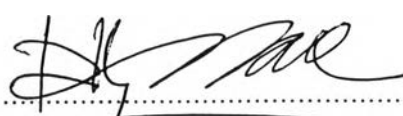

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บทคัดย่อ

จิติพร ทองศรีเกตุ : การศึกษาปฏิกิริยาอะโรมาไทเซชันของนอร์มัลเฮกเซนเป็นเบนซีน บนตัวเร่งปฏิกิริยาแพลตินัม/โพแทสเซียมซีโอไลต์แอลและแพลตินัมอิธเทอร์เบียม/โพแทสเซียมซีโอไลต์แอลซึ่งเตรียมขึ้นด้วยวิธีชีวิต (n-Hexane Aromatization to Benzene on Pt/KL and PtYb/KL Prepared by CVD Method) อ. ที่ปรึกษา : ศ.ดร. แคนเน็ล อี-ริชส์โก ศ.ดร. สมชาย ไอสวรรณ และ ผศ.ดร. ธีรศักดิ์ ฤกษ์สมบูรณ์ 54 หน้า ISBN 974-334-160-9

ตัวเร่งปฏิกิริยาแพลตินัมบนพื้นผิวโพแทสเซียมซีโอไลต์แอล (Pt/KL) และ แพลตินัมอิธเทอร์เบียมบนพื้นผิวโพแทสเซียมซีโอไลต์แอล (PtYb/KL) เตรียมขึ้นโดยวิธีฝังตัว (incipient wetness impregnation, IWI) และ การระเหิดสารเข้าสู่โพรงของซีโอไลต์ (chemical vapor deposition, CVD) ตัวเร่งปฏิกิริยาถูกทดสอบประสิทธิภาพที่อุณหภูมิ 400 และ 500 องศาเซลเซียส โดยใช้ นอร์มัลเฮกเซนบริสุทธิ์และที่เจือซัลเฟอร์เพื่อศึกษาผลของซัลเฟอร์ในปริมาณ 0.6 และ 2.5 ส่วนในล้านส่วน (ppm) เป็นสารตั้งต้นในการผลิตเบนซีน (benzene) ผลการศึกษาด้วยอินฟราเรดแบบฟูเรียร์ทรานส์ฟอร์ม (FT-IR) และ การวัดปริมาณไฮโดรเจนที่เกิดพันธะเคมีกับแพลตินัม (hydrogen chemisorption) แสดงว่าการการระเหิดสารเข้าสู่โพรงของซีโอไลต์ให้การกระจายตัวที่ดีกว่าและขนาดของกลุ่มที่เล็กกว่าของแพลตินัมส่วนใหญ่ที่ฝังตัวอยู่ในโพรงซีโอไลต์ ต่างกับการฝังตัว ที่พบว่าแพลตินัมมีขนาดใหญ่และอยู่นอกโพรง ความแตกต่างนี้ทำให้แพลตินัมที่เตรียมโดยวิธีการฝังตัวในรูปของไอมีความสามารถในการเปลี่ยนสารตั้งต้น (conversion) สูง และยังมีความเฉพาะเจาะจง (selectivity) ในการผลิตเบนซีนที่สูงด้วย รวมทั้งมีความเสถียร (stability) ต่ออุณหภูมิที่สูงขึ้นด้วย นอกจากนี้เมื่อประสิทธิภาพในการเปลี่ยนแปลงสารตั้งต้นต่ำลง ตัวเร่งปฏิกิริยาจากวิธีชีวิตก็ยังคงมีความเฉพาะเจาะจงในการผลิตเบนซีนที่สูงอยู่ อย่างไรก็ตามการศึกษาที่อุณหภูมิ 400 องศาเซลเซียส พบว่าตัวเร่งปฏิกิริยาที่มีอิธเทอร์เบียมมีความสามารถในการเปลี่ยนแปลงสารตั้งต้นต่ำ แต่จะมีความสามารถมากขึ้นเมื่ออยู่ในภาวะที่มีซัลเฟอร์เจืออยู่

ABSTRACT

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KEYWORD: Pt/KL/CVD/Ytterbium/SulfurTolerance

Thitiporn Thongsrikate: n-Hexane Aromatization to Benzene on Pt/KL and PtYb/KL Catalysts Prepared by CVD Method. Thesis Advisors: Prof. Danial E. Resasco, Prof. Somchai Osuwan and Assist. Prof. Thirasak Rirksomboon, 54 pp ISBN 974-334-160-9

The catalytic performances on the n-hexane aromatization of Pt/KL and PtYb/KL catalysts were investigated at various temperatures using sulfur-free, 0.6 ppm and 2.5 ppm sulfur-containing feedstocks. The incipient wetness impregnation (IWI) and chemical vapor deposition (CVD) were used to prepare both types of the catalysts. The results from FT-IR and chemisorption studies revealed that the CVD catalysts had a high dispersion with a majority of small Pt clusters inside the L-zeolite channels, especially at 400°C. This morphology resulted in high catalyst stability and selectivity to benzene formation, even in the presence of sulfur, in contrast to IWI, which showed lower selectivity and more rapid deactivation. In addition, when the weight hourly space velocity was increased, the CVD catalysts still maintained high selectivity indicating a unique ability of these catalysts for the aromatization. Although the addition of Yb promoter did not play an important role in the absence of sulfur in the feed, under sulfur-containing feed it improved the catalytic performance at 400°C.

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ABBREVIATIONS

CVD	Chemical vapor deposition
IWI	Incipient wetness impregnation
Zeolite L	Zeolite type LTL
Pt/KL	Platinum on L zeolite supported
PtYb/KL	Platinum on ytterbium promoted L zeolite supported
FTIR	Fourier transform infrared
GC	Gas chromatograph
WHSV	Weigh hourly space velocity
IWI 400	Pt/KL prepared by IWI method at reduction and reaction temperature 400 °C
IWI 500	Pt/KL prepared by IWI method at reduction and reaction temperature 500 °C
CVD 400	Pt/KL prepared by CVD method at reduction and reaction temperature 400 °C
CVD 500	Pt/KL prepared by CVD method at reduction and reaction temperature 500 °C
Yb 400	PtYb/KL prepared by CVD method at reduction and reaction temperature 400 °C
Yb 500	PtYb/KL prepared by CVD method at reduction and reaction temperature 500 °C
IWI @ 400	Pt/KL prepared by IWI method after reducing at 400 °C
IWI @ 500	Pt/KL prepared by IWI method after reducing at 500 °C
CVD @ 400	Pt/KL prepared by CVD method after reducing at 400 °C
CVD @ 500	Pt/KL prepared by CVD method after reducing at 500 °C
Yb @ 400	PtYb/KL prepared by CVD method after reducing at 400 °C

Yb @ 500	PtYb/KL prepared by CVD method after reducing at 500 °C
0.6 S CVD 400	Pt/KL prepared by CVD method under 0.6 ppm sulfur containing feed at 400 °C
0.6 S CVD 500	Pt/KL prepared by CVD method under 0.6 ppm sulfur containing feed at 500 °C
0.6 S Yb 400	PtYb/KL prepared by CVD method under 0.6 ppm sulfur containing feed at 400 °C
0.6 S Yb 500	PtYb/KL prepared by CVD method under 0.6 ppm sulfur containing feed at 500 °C
2.5 S CVD 400	Pt/KL prepared by CVD method under 2.5 ppm sulfur containing feed at 400 °C
2.5 S CVD 500	Pt/KL prepared by CVD method under 2.5 ppm sulfur containing feed at 500 °C
2.5 S Yb 400	PtYb/KL prepared by CVD method under 2.5 ppm sulfur containing feed at 400 °C
2.5 S Yb 500	PtYb/KL prepared by CVD method under 2.5 ppm sulfur containing feed at 500 °C