

การศึกษากลไกการเกิดปฏิกิริยาการรีดิวซ์ไนตริกออกไซด์ด้วยสารไฮโดรคาร์บอนขณะที่มี

ออกซิเจนมากเกินไปบนตัวเร่งปฏิกิริยาแพลทินัมจากการสังเกตสปีชีส์บนพื้นผิว



นายชวงค์ ชัยสุข

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรดุษฎีบัณฑิต

สาขาวิชาวิศวกรรมเคมี ภาควิชาวิศวกรรมเคมี

คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

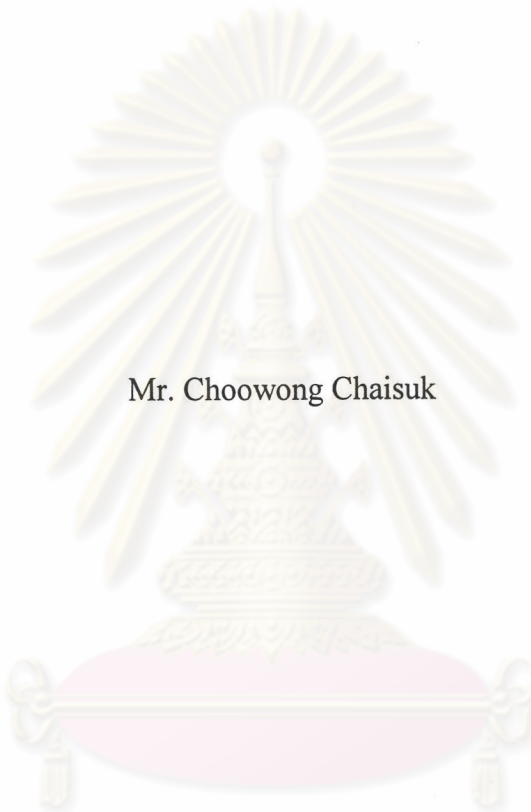
ปีการศึกษา 2544

ISBN 974-03-1271-3

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

I205 14979

STUDY OF REACTION MECHANISM OF THE REDUCTION OF NITRIC
OXIDE BY HYDROCARBON IN EXCESS OXYGEN OVER A PLATINUM
CATALYST VIA THE INVESTIGATION OF SURFACE SPECIES



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A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Engineering in Chemical Engineering

Department of Chemical Engineering

Faculty of Engineering

Chulalongkorn University

Academic Year 2001

ISBN 974-03-1271-3

Thesis Title Study of reaction mechanism of the reduction of nitric oxide by hydrocarbon in excess oxygen over a platinum catalyst via the investigation of surface species


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Field of study Chemical Engineering

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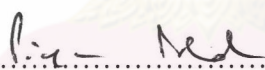
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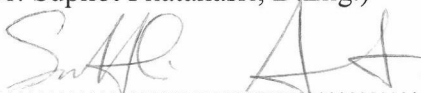

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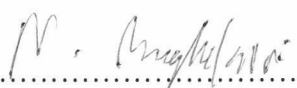

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ชวงศ์ ชัยสุข: การศึกษากลไกการเกิดปฏิกิริยาการรีดิวซ์ไนตริกออกไซด์ด้วยสารไฮโดรคาร์บอนบนโลหะที่มีออกซิเจนมากเกินพอบนตัวเร่งปฏิกิริยาแพลทินัมจากการสังเกตสปีชีส์บนพื้นผิว (STUDY OF REACTION MECHANISM OF THE REDUCTION OF NITRIC OXIDE BY HYDROCARBON IN EXCESS OXYGEN OVER A PLATINUM CATALYST VIA THE INVESTIGATION OF SURFACE SPECIES) อ. ที่ปรึกษา: ศ.ดร.ปิยะสาร ประเสริฐธรรม, อาจารย์ที่ปรึกษาร่วม: รศ.ดร.ธราธร มงคลศรี และ ดร.ศิริพล คุณาธิปพงษ์, 222 หน้า ISBN 974-03-1271-3.

ในงานวิจัยนี้ ได้นำเสนอกลไกการเกิดปฏิกิริยาของปฏิกิริยาการรีดิวซ์แบบเลือกเกิดของไนตริกออกไซด์ด้วยสารไฮโดรคาร์บอนบนตัวเร่งปฏิกิริยาแพลทินัมรองรับด้วยอลูมินา ภายใต้บรรยากาศที่มีออกซิเจนมากเกินพอ โดยทำการศึกษาสปีชีส์ที่เกิดขึ้นบนพื้นผิวของตัวเร่งปฏิกิริยาเมื่อใช้โพรพีนเป็นสารตั้งต้น สำหรับชุดการทดลองที่มี 3 ขั้นตอนต่อเนื่องกัน ประกอบด้วย ขั้นตอนการเกิดปฏิกิริยา ขั้นตอนการทำให้หลุดออกแบบโปรแกรมอุณหภูมิ และขั้นตอนการออกซิเดชันแบบโปรแกรมอุณหภูมิ พบว่ามีสปีชีส์อย่างน้อย 3 ชนิด เกิดขึ้นบนตัวเร่งปฏิกิริยาแพลทินัมรองรับด้วยอลูมินา การสังเกตการถูกกระตุ้นซ้ำของสปีชีส์ด้วยแก๊สออกไซด์ต่าง ๆ และการศึกษาธรรมชาติของสปีชีส์หลังจากการเติมซัลเฟอร์ไดออกไซด์ลงในแก๊สตั้งต้นผสม ซึ่งให้เห็นว่ามีการเกิดปฏิกิริยา 2 ถึง 3 กลไก เกิดขึ้นพร้อมกันที่ภาวะของปฏิกิริยาเดียวกัน ด้วยเหตุนี้จึงยากที่จะควบคุมเส้นทางการเกิดปฏิกิริยาที่ต้องการบนตัวเร่งปฏิกิริยาชนิดนี้ อย่างไรก็ตามที่อุณหภูมิต่ำซึ่งการออกซิเดชันโพรพีนเกิดขึ้นได้ไม่สมบูรณ์ พบว่าสารประกอบไฮโดรคาร์บอนที่ถูกออกซิไดส์บางส่วนซึ่งสามารถสลายตัวได้เองที่อุณหภูมิสูง เป็นสารประกอบเพียงตัวเดียวที่แสดงบทบาทสำคัญอย่างชัดเจนในปฏิกิริยาดังกล่าว ในขณะที่การศึกษาสปีชีส์ด้วยวิธีนี้ ไม่สามารถที่จะประยุกต์ใช้กับปฏิกิริยาข้างต้นด้วยการใช้โพรเพนเป็นสารตั้งต้นแทนโพรพีน ได้อย่างมีประสิทธิภาพ เนื่องจากสปีชีส์ที่ได้มา เป็นสปีชีส์ที่ไม่เกี่ยวข้องกับปฏิกิริยา

จุฬาลงกรณ์มหาวิทยาลัย

ภาควิชา.....วิศวกรรมเคมี.....	ลายมือชื่อนิสิต..... <i>ฟุค ฟูฟุ</i>
สาขาวิชา.....วิศวกรรมเคมี.....	ลายมือชื่ออาจารย์ที่ปรึกษา..... <i>ช ช</i>
ปีการศึกษา.....2544.....	ลายมือชื่ออาจารย์ที่ปรึกษาร่วม..... <i>ดร.อรอนงค์</i>
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#3970464721: MAJOR CHEMICAL ENGINEERING

KEY WORD: Pt/Al₂O₃ catalyst/ SCR of NO by hydrocarbon/ reaction mechanism/ surface species

CHOOWONG CHAISUK: STUDY OF REACTION MECHANISM OF THE REDUCTION OF NITRIC OXIDE BY HYDROCARBON IN EXCESS OXYGEN OVER A PLATINUM CATALYST VIA THE INVESTIGATION OF SURFACE SPECIES. THESIS ADVISOR: PROF. PIYASAN PRASERTHDAM, Dr.Ing., THESIS COADVISOR: ASSOC. PROF. THARATHON MONGKHONSI, Ph.D., and DR. SIRIPOLN KUNATIPPAPONG, D.Eng., 222 pp. ISBN 974-03-1271-3.

In this thesis, the reaction mechanism of the selective catalytic reduction of nitric oxide by hydrocarbon over Pt/Al₂O₃ catalyst under excess oxygen is proposed via the investigation of surface species produced on the catalyst surface. With propene as a model reductant, an experimental set of three continuous steps consisting of reaction step, temperature programmed desorption step and temperature programmed oxidation step was carried out. It can be observed that there are at least three types of surface species occurred on Pt/Al₂O₃ catalyst. The observation of the reactivity of surface species to various oxidizing gases and the investigation of the nature of surface species after the addition of sulfur dioxide in the reactant gas mixture indicate that a few mechanisms are simultaneously proceeded at the same reaction condition. Hence, it is difficult to control the required reaction mechanism pathway over this catalyst. However, at low operating temperature where propene oxidation is not completed, the only partially oxidized hydrocarbon compounds, which decompose themselves at high temperatures, distinctly play an important role in such reaction. Unfortunately, the investigation of surface species can not effectively apply with the above reaction using propane as a reductant instead of propene due to the obtained surface species behaving as the spectator species.

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ACKNOWLEDGEMENTS

Of the many people who have been enormously helpful in the doctoral course, the author would like to give special recognition to Professor Piyasan Praserttham, his advisor, for his invaluable suggestions and highly constructive comments. He is similarly grateful for the heartfelt assistance, encouragement and friendship that he has received from Associate Professor Tharathon Mongkhonsi and Dr. Siripoln Kunatippapong, his co-advisors. In particular, he also appreciates for their kind cooperation he has had with Professor Wiwut Tanthapanichakoon who has been the chairman of the committee, Dr. Suphot Phatanasri, Assistant Professor Suttichai Assabumrungrat and Dr. Nakin Mongkolsiri who have been members of the committee.

Also, he gratefully acknowledges the generous financial support given by National Science and Technology Development Agency (NSTDA) and Thailand Research Fund (TRF).

In this study, he benefits greatly from the special insights of his colleagues, Dr. Sune Srihiranpullop, Miss Bongkot Ngamsom, Mr. Apiwat Panit, Mr. Kriangsak Kraiwattanawong and Mr. Suwat Limtrakul, who shared ideas and material with him. To the many others not specially named who have provided him with information, support and encouragement, please be assured that he thinks of them. His thanks also go to the Department of Chemical engineering, Chulalongkorn University, for the creative and challenging atmosphere in which he has been fortune to work.

Finally, he once again owes a special debt to thank to his parents. Their unyielding support and generous love not only made this work possible but also are worth while doing the first place.

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