การศึกษากลไกการเกิดปฏิกิริยาการรีดิวซ์ไนตริกออกไซด์ด้วยสารไฮโดรคาร์บอนขณะที่มีออกซิเจนมากเกินพอบนตัวเร่งปฏิกิริยาแพลทินัมจากการสังเกตสปีชีส์บนพื้นผิว

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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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ชูวงศ์ ชัยสุข: การศึกษากลไกการเกิดปฏิกิริยาการรีดิวซ์ไนตริกออกไซด์ด้วยสารไฮโดรคาร์บอนขณะที่มีออกซิเจนมากเกินพอบนตัวเร่งปฏิกิริยาแพลทินัมจากการสังเกตสปีชีส์บนพื้นผิว (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 การสังเกตการถูกกระตุ้นซ้ำของสปีชีส์ด้วยแก๊สออกซิไดส์ต่าง ๆ และการศึกษาธรรมชาติของสปีชีส์หลังจากการเติมซัลเฟอร์ไดออกไซด์ลงในแก๊สตั้งต้นผสม ชี้ให้เห็นว่ามีกลไกการเกิดปฏิกิริยา 2 ถึง 3 กลไก เกิดขึ้นพร้อมกันที่ภาวะของปฏิกิริยาเดียวกัน ด้วยเหตุนี้จึงยากที่จะควบคุมเส้นทางการเกิดปฏิกิริยาที่ต้องการบนตัวเร่งปฏิกิริยาชนิดนี้ อย่างไรก็ตามที่อุณหภูมิต่ำซึ่งการออกซิเดชันโพรพีนเกิดขึ้นได้ไม่สมบูรณ์ พบว่าสารประกอบไฮโดรคาร์บอนที่ถูกออกซิไดส์บางส่วนซึ่งสามารถสลายตัวได้เองที่อุณหภูมิสูง เป็นสารประกอบเพียงตัวเดียวที่แสดงบทบาทสำคัญอย่างชัดเจนในปฏิกิริยาดังกล่าว ในขณะที่การศึกษาสปีชีส์ด้วยวิธีนี้ ไม่สามารถที่จะประยุกต์ใช้กับปฏิกิริยาข้างต้นด้วยการใช้โพรเพนเป็นสารตั้งต้นแทนโพรพีน ได้อย่างมีประสิทธิภาพ เนื่องจากสปีชีส์ที่ได้มา เป็นสปีชีส์ที่ไม่เกี่ยวข้องกับปฏิกิริยา

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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/Al_2O_3 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/Al_2O_3 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.

Department…Chemical Engineering…… Student's signature……Choowong Chaisuk……

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Academic year……2001……...Co-advisor's signature……

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