

**PREFERENTIAL OXIDATION OF CO IN THE PRESENCE OF H₂ OVER
Au-Pt AND Pt SUPPORTED ON MORDENITE CATALYSTS**



Prang Kiatkumjai

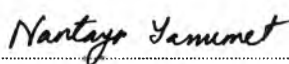
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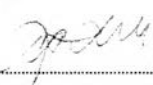
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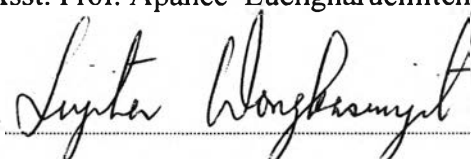
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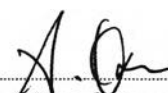
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ABSTRACT

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Prang Kiatkumjai: Preferential Oxidation of CO in the Presence of H₂ over Au-Pt and Pt Supported on Mordenite Catalysts

Thesis Advisors: Asst. Prof. Apanee Luengnaruemitchai, and Assoc. Prof. Sujitra Wongkasemjit 70 pp.

Keywords: Preferential CO Oxidation/ Gold/ Platinum/ Zeolite Catalyst

The preferential oxidation of CO (PROX) in H₂-rich gas has long been an interesting technique for the purification of hydrogen gas, especially for use in proton exchange membrane fuel cells (PEMFC), because low levels of CO contaminant can affect the PEMFC electrodes. In this work, bimetallic Au-Pt/mordenite and Pt/mordenite catalysts prepared by the deposition-precipitation method were investigated for the PROX. The effects of Au:Pt ratio, catalyst pretreatment and calcination on the catalytic performance were studied. The CO conversion and selectivity of the prepared catalysts are presented in the temperature range of 50-310°C. Among the bimetallic catalysts tested, a maximum CO conversion of 89.13% was achieved at 230°C with 1% by wt. Au:Pt/mordenite (1:5) pretreated with O₂, while 1% by wt. Pt/mordenite pretreated with H₂ gave 100% CO conversion and 48.14% selectivity at 170°C. In addition, the 1% Pt/mordenite was applied for the PROX unit of the fuel processor system for the production of H₂-rich gas, starting from natural gas. The gas stream product gave the H₂ and CO concentration of 57.09% and 334 ppm, respectively.

บทคัดย่อ

ปรากฏเกียรติกำจาย : การเลือกเกิดปฏิกิริยาออกซิเดชันของก๊าซคาร์บอนมอนอกไซด์ในบรรยากาศไฮโดรเจนโดยใช้ตัวเร่งปฏิกิริยาควาทอง-แพลทินัมและแพลทินัมบนตัวรองรับโมดิไนด์ (Preferential Oxidation of CO in the Presence of H₂ over Au-Pt and Pt Supported on Mordenite Catalysts) อ. ที่ปรึกษา : ผศ.ดร. อาภาณี เหลืองนฤมิตชัย และ รศ.ดร. สุจิตรา วงศ์เกษมจิตต์ 70 หน้า

การเลือกเกิดปฏิกิริยาออกซิเดชันของคาร์บอนมอนอกไซด์ (Preferential oxidation of CO) ในบรรยากาศไฮโดรเจน เป็นวิธีการหนึ่งที่น่าสนใจในการทำก๊าซไฮโดรเจนให้บริสุทธิ์ โดยเฉพาะสำหรับการประยุกต์ใช้ในเซลล์เชื้อเพลิงแบบเยื่อแลกเปลี่ยนโปรตอน (Proton Exchange Membrane Fuel Cell: PEMFC) เนื่องจากปริมาณก๊าซคาร์บอนมอนอกไซด์เพียงเล็กน้อยจะส่งผลกระทบต่อการทำงานของตัวเร่งปฏิกิริยาแพลทินัมในเซลล์เชื้อเพลิงแบบเยื่อแลกเปลี่ยนโปรตอน ในงานวิจัยนี้มีการศึกษาตัวเร่งปฏิกิริยาสำหรับการเลือกเกิดปฏิกิริยาออกซิเดชันของคาร์บอนมอนอกไซด์ในบรรยากาศไฮโดรเจน โดยตัวเร่งปฏิกิริยาที่ศึกษาคือตัวเร่งปฏิกิริยาโลหะทองและแพลทินัมบนตัวรองรับโมดิไนด์ ซึ่งเตรียมโดยวิธีการ Deposition-precipitation มีการศึกษาผลของอัตราส่วนโดยน้ำหนักระหว่างโลหะทองต่อแพลทินัม การพรีทรีทเมนต์ และการเคลือบชั้นของตัวเร่งปฏิกิริยา โดยแสดงผลของการเปลี่ยนแปลงของก๊าซคาร์บอนมอนอกไซด์ (CO conversion) และความเลือกจำเพาะ (Selectivity) ของตัวเร่งปฏิกิริยาในช่วงอุณหภูมิ 50-310 องศาเซลเซียส พบว่าตัวเร่งปฏิกิริยาโลหะทอง-แพลทินัมบนตัวเร่งปฏิกิริยาทองบนตัวรองรับโมดิไนด์อัตราส่วนโดยน้ำหนัก 1 ต่อ 5 ในปริมาณโลหะรวมร้อยละ 1 ที่ทำการพรีทรีทเมนต์ด้วยก๊าซออกซิเจน ให้ค่าการเปลี่ยนแปลงของก๊าซคาร์บอนมอนอกไซด์ 89.13% ที่อุณหภูมิ 230 องศาเซลเซียส ในขณะที่ตัวเร่งปฏิกิริยาโลหะแพลทินัมบนตัวรองรับโมดิไนด์ที่ปริมาณโลหะรวมร้อยละ 1 ที่ทำการพรีทรีทเมนต์ด้วยตัวเร่งปฏิกิริยาด้วยก๊าซไฮโดรเจนให้ค่าการเปลี่ยนแปลงของก๊าซคาร์บอนมอนอกไซด์ 100% และค่าความเลือกจำเพาะ 48.14% ที่อุณหภูมิ 170 องศาเซลเซียส นอกจากนี้ งานวิจัยนี้มีการนำตัวเร่งปฏิกิริยาโลหะแพลทินัมบนตัวรองรับโมดิไนด์มาใช้ในการจำลองการผลิตเชื้อเพลิงไฮโดรเจนจากปฏิกิริยาารีฟอร์มมิงที่ผลิตจากก๊าซธรรมชาติใน Fuel Processor พบว่าในก๊าซผลิตภัณฑ์ให้ความเข้มข้นของก๊าซไฮโดรเจน 57.09% และก๊าซคาร์บอนมอนอกไซด์ 334 ส่วนในล้านส่วน

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