

**SELECTIVE CO OXIDATION IN THE PRESENCE OF  
HYDROGEN FOR FUEL CELL APPLICATIONS: Au/TiO<sub>2</sub> CATALYSTS**

Ms. Oranan Khongkruaphan

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**By:** Ms. Oranan Khongkruaphan  
**Program:** Petrochemical Technology  
**Thesis Advisors:** Professor Somchai Osuwan  
Ms. Apanee Luengnaruemitchai  
Professor Erdogan Gulari

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*K. Bunyakiat.*

..... College Director

(Assoc. Prof. Kunchana Bunyakiat)

**Thesis Committee:**

*Somchai Osuwan*

.....  
(Prof. Somchai Osuwan)

*Apanee Luengnaruemitchai*

.....  
(Ms. Apanee Luengnaruemitchai)

*Erdogan Gulari*

.....  
(Prof. Erdogan Gulari)

*Sumaeth Chavadej*

.....  
(Assoc. Prof. Sumaeth Chavadej)

*Thirasak Rirksomboon*

.....  
(Assoc. Prof. Thirasak Rirksomboon)

**ABSTRACT**

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The catalytic performances of Au/TiO<sub>2</sub> catalysts in selective CO oxidation in the presence of excess hydrogen for fuel cell applications were studied at various conditions. The reactant gas consisting of 1% CO, 1% O<sub>2</sub>, 2% CO<sub>2</sub>, 2.6% H<sub>2</sub>O, and 40% H<sub>2</sub> balanced in He was used for testing reaction in the temperature range of 50-190°C. Deposition-precipitation (DP) and impregnation on sol-gel support (ISG) methods were used to prepare the catalysts. From the results, the DP catalysts exhibited much higher activity than the ISG catalysts. The calcination temperature and %Au loading had strong effects on catalytic activity. The 1% Au/TiO<sub>2</sub> catalyst prepared by DP method calcined at 400°C for 5 h showed the highest activity among the other prepared catalysts. The addition of Mg citrate as a promoter was also investigated to improve the catalytic performance of 1% Au/TiO<sub>2</sub> catalyst. Increasing amount of CO<sub>2</sub> present in the reactant gas resulted in a decrease in catalytic activity; however, the catalytic activity increased with increasing H<sub>2</sub>O content in the reactant gas.

## บทคัดย่อ

อรนันท์ คงเครือพันธุ์: การเลือกเกิดปฏิกิริยาออกซิเดชันของก๊าซคาร์บอนมอนอกไซด์ในบรรยากาศก๊าซไฮโดรเจนสำหรับประยุกต์ใช้ในเซลล์เชื้อเพลิงโดยตัวเร่งปฏิกิริยา Au/TiO<sub>2</sub> (Selective CO Oxidation in the Presence of Hydrogen for Fuel Cell Applications: Au/TiO<sub>2</sub> Catalysts) อ. ที่ปรึกษา: ศ.ดร. เออโดแกน กุลารี่ ศ.ดร.สมชาย โอสุวรรณ และ อาจารย์ อาภาณี เหลืองนฤมิตรชัย 60 หน้า ISBN 974-17-2269-9

ได้ทำการศึกษาความสามารถในการเร่งปฏิกิริยาที่สภาวะต่างๆ ของตัวเร่งปฏิกิริยาโลหะทองบนตัวรองรับไททานีตต่อการเลือกเกิดปฏิกิริยาออกซิเดชันของก๊าซคาร์บอนมอนอกไซด์ในบรรยากาศก๊าซไฮโดรเจนสำหรับประยุกต์ใช้ในเซลล์เชื้อเพลิง ก๊าซตั้งต้นประกอบด้วยก๊าซคาร์บอนมอนอกไซด์ร้อยละ 1, ก๊าซออกซิเจนร้อยละ 1, ก๊าซคาร์บอนไดออกไซด์ร้อยละ 2, ไอน้ำร้อยละ 2.6, และก๊าซไฮโดรเจนร้อยละ 40 ปรับสมดุลในก๊าซฮีเลียมใช้สำหรับเกิดปฏิกิริยาที่ช่วงอุณหภูมิ 50-190 องศาเซลเซียส โดยใช้ตัวเร่งปฏิกิริยาที่เตรียมขึ้นด้วยวิธีการเตรียมแบบจับตัวตกตะกอน และแบบฝังตัวบนตัวรองรับโซลเจล ผลการศึกษาความสามารถในการทำปฏิกิริยาพบว่าตัวเร่งปฏิกิริยาแบบจับตัวตกตะกอนให้ประสิทธิภาพที่สูงกว่าที่เตรียมแบบฝังตัวบนตัวรองรับโซลเจล การวิจัยนี้พบว่าการเผาที่อุณหภูมิสูงและค่าน้ำหนักร้อยละของโลหะทองมีผลต่อความว่องไวของตัวเร่งปฏิกิริยา ที่ร้อยละหนึ่งโดยน้ำหนักของโลหะทองบนตัวรองรับไททานีตที่เตรียมแบบจับตัวตกตะกอนโดยเผาอุณหภูมิสูงที่ 400 องศาเซลเซียส เป็นเวลา 5 ชั่วโมง ให้ประสิทธิภาพสูงที่สุดเมื่อเทียบกับตัวเร่งปฏิกิริยาอื่น ๆ ที่เตรียม การใส่สารแมกนีเซียมซีเตรตเป็นตัวช่วยเกิดปฏิกิริยาทำให้เพิ่มความสามารถของตัวเร่งปฏิกิริยา การเพิ่มปริมาณส่วนประกอบของก๊าซคาร์บอนไดออกไซด์ในก๊าซตั้งต้นส่งผลให้ความว่องไวของตัวเร่งปฏิกิริยาลดลง อย่างไรก็ตามความว่องไวของตัวเร่งปฏิกิริยาสูงขึ้นเมื่อเพิ่มปริมาณไอน้ำในก๊าซตั้งต้น

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