

**SELECTIVE CO OXIDATION IN THE PRESENCE OF HYDROGEN FOR
FUEL CELL APPLICATIONS: Au/MnO_x AND Au/FeO_x CATALYSTS**

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ABSTRACT

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Keywords : Fuel cells/ CO oxidation/ Gold/ Manganese oxide/ Ferrous oxide.

Gold itself exhibits poor activity but becomes more active for CO oxidation when deposited onto an appropriate support. Manganese and ferrous oxides were found to be good supports for gold in selective CO oxidation for fuel cell applications. Catalysts were prepared by co-precipitation method and subjected to several pretreatment conditions before being tested for CO oxidation activity. The activity was tested using a gas mixture of 1% CO, 1% O₂, 2% CO₂, 2.6% H₂O, and 40% H₂ balanced in He in the temperature range 50-190°C. Au/MnO_x preferred He pretreatment and 300°C calcination temperature while Au/FeO_x preferred O₂ pretreatment and 400°C calcination temperature. Atomic ratio of 1/30 gold to base metal was the optimum Au loading for both catalysts. High concentration of CO₂ in the feed gas was also investigated in order to observe the adverse effect due to the reverse water gas shift equilibrium. Interestingly, both catalysts could resist to H₂O concentration in the reactant feed up to the level of 10%. Au/MnO_x gave 93% conversion and 58% selectivity at 130°C and Au/FeO_x gave 98% conversion and 53% selectivity at 50°C during a 48 h stability test without any activity drop at all.

บทคัดย่อ

Dao Thi Kim Thoa: การเลือกเกิดปฏิกิริยาออกซิเดชันของก๊าซคาร์บอนมอนอกไซด์ในบรรยากาศก๊าซไฮโดรเจนสำหรับประยุกต์ใช้ในเซลล์เชื้อเพลิงโดยตัวเร่งปฏิกิริยา Au/MnO_x และ Au/FeO_x (Selective CO Oxidation in the Presence of Hydrogen for Fuel Cell Applications: Au/MnO_x and Au/FeO_x Catalysts) อ. ที่ปรึกษา: ศ.ดร. เอโดแกน กุลารี่ ศ.ดร.สมชาย ไอสุวรรณ และ อาจารย์อภานี เหลืองนฤมิตชัย 70 หน้า ISBN 974-17-2278-8

ตัวโลหะทองแสดงความไวต่อปฏิกิริยาค่า แต่กลับแสดงความไวสูงต่อปฏิกิริยาออกซิเดชันของก๊าซคาร์บอนมอนอกไซด์เมื่อรองรับด้วยตัวรองรับที่เหมาะสม โดยที่แมงกานีสและเฟอร์รัสออกไซด์เป็นตัวรองรับที่ดีสำหรับโลหะทองในการเลือกเกิดปฏิกิริยาออกซิเดชันของก๊าซคาร์บอนมอนอกไซด์ในบรรยากาศก๊าซไฮโดรเจนสำหรับประยุกต์ใช้ในเซลล์เชื้อเพลิง ตัวเร่งปฏิกิริยาเตรียมขึ้นด้วยวิธีการเตรียมแบบคกตะกอนร่วมและได้ปรับสภาพที่สภาวะต่าง ๆ ก่อนการศึกษาความไวของตัวเร่งปฏิกิริยา โดยส่วนประกอบของก๊าซตั้งต้นคือก๊าซคาร์บอนมอนอกไซด์ร้อยละ 1, ก๊าซออกซิเจนร้อยละ 1, ก๊าซคาร์บอนไดออกไซด์ร้อยละ 2, ไอน้ำร้อยละ 2.6, และก๊าซไฮโดรเจนร้อยละ 40 ปรับสมดุลด้วยก๊าซฮีเลียมที่ช่วงอุณหภูมิ 50-190 องศาเซลเซียส Au/MnO_x ชอบการปรับสภาพด้วยก๊าซฮีเลียมและเผาอุณหภูมิสูงที่ 300 องศาเซลเซียส ในขณะที่ Au/FeO_x ชอบการปรับสภาพด้วยก๊าซออกซิเจนและเผาอุณหภูมิสูงที่ 400 องศาเซลเซียส อัตราส่วนอะตอม 1/30 ของโลหะทองเหมาะสมต่อตัวเร่งปฏิกิริยาทั้งคู่ ความเข้มข้นสูงของก๊าซคาร์บอนไดออกไซด์ในส่วนประกอบของก๊าซตั้งต้นได้ถูกศึกษาโดยส่งผลเป็นลบเนื่องจากความสมดุลปฏิกิริยาผันกลับได้ของ water gas shift เป็นที่น่าสนใจที่ตัวเร่งปฏิกิริยาทั้งคู่สามารถทนต่อความเข้มข้นของไอน้ำระดับ 10% ตัวเร่งปฏิกิริยา Au/MnO_x ให้ค่าความเปลี่ยนแปลงถึง 93% และค่าการเลือกเกิดปฏิกิริยาถึง 58% ที่อุณหภูมิ 130 องศาเซลเซียส และ Au/FeO_x ให้ค่าความเปลี่ยนแปลงถึง 98% และค่าการเลือกเกิดปฏิกิริยาถึง 53% ที่อุณหภูมิ 50 องศาเซลเซียส โดยความไวของตัวเร่งปฏิกิริยาไม่มีการลดต่ำลงในช่วงเวลา 48 ชั่วโมง

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TABLE OF CONTENTS

	PAGE
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	ix
List of Figures	x
CHAPTER	
I INTRODUCTION	1
1.1 Introduction	1
1.2 Research Objectives	4
II LITERATURE REVIEW	5
2.1 Background	5
2.2 Literature Review	8
III EXPERIMENTAL	12
3.1 Materials	12
3.1.1 Gases	12
3.1.2 Chemicals	12
3.2 Equipment	13
3.2.1 Gas Blending System	13
3.2.2 Catalytic Reactor	13
3.2.3 Analytical Instrumentation	13
3.3 Catalyst Preparation Procedure	15
3.4 Catalyst Characterization	15
3.4.1 BET Surface Area Measurement	15
3.4.2 X-Ray Diffraction	17

3.4.3	Atomic Absorption Spectroscopy	18
3.4.4	Transmission Electron Microscopy	18
3.4.5	Thermal Gravity Analysis	19
3.5	Activity Measurement	19
3.5.1	Effect of Catalyst Pretreatment	20
3.5.2	Effect of Calcination Temperature	20
3.5.3	Effect of Au loading	20
3.5.4	Effect of CO ₂ Concentration in the Feed Gas	20
3.5.5	Effect of H ₂ O Concentration in the Feed Gas	21
3.5.6	Deactivation Test	21
3.6	Calculation	21
3.7	Experimental Plan	22
3.7.1	Effect of Catalyst Pretreatment	24
3.7.2	Effect of Calcination Temperature	24
3.7.3	Effect of Au Loading	24
3.7.4	Effect of CO ₂ Concentration in the Feed Gas	25
3.7.5	Effect of H ₂ O Concentration in the Feed Gas	25
3.7.6	Deactivation Test	25
IV	SELECTIVE CO OXIDATION IN HYDROGEN RICH STREAM OVER Au/MnO_x AND Au/FeO_x CATALYSTS	26
	Abstract	26
	Introduction	26
	Experimental	28
	Results and Discussion	30
	Conclusions	37
	Acknowledgements	37
	References	38
V	CONCLUSIONS AND RECOMMENDATIONS	65
5.1	Conclusions	65
5.2	Recommendations	65

REFERENCES

67

CURRICULUM VITAE

70

LIST OF TABLES

TABLE		PAGE
CHAPTER II		
2.1	Fuel cell types distinguished by the electrolyte	5
2.2	Typical electrochemical reactions in fuel cells	6
2.3	Preferred electrocatalysts for the main fuel cells	6
CHAPTER III		
3.1	Values of the geometric factor (g), such as $d = gD_b$	18
3.2	Experimental plan	23
3.3	Experimental plan for effect of catalyst pretreatment	24
3.4	Experimental plan for effect of calcination temperature	24
3.5	Experimental plan for effect of Au loading	24
3.6	Experimental plan for effect of CO ₂ in the feed gas	25
3.7	Experimental plan for effect of H ₂ O in the feed gas	25
3.8	Experimental plan for deactivation test	25
CHAPTER IV		
1	Surface area, pore and crystallite sizes of prepared catalysts	41
2	Actual Au loading on prepared catalysts	42
3	Result summarization	43

LIST OF FIGURES

FIGURE		PAGE
CHAPTER I		
1.1	Schematic drawing of a Proton Exchange Membrane (PEM) fuel cell.	2
CHAPTER II		
2.1	Fuel cells poisoning by CO (PEM Fuel Cell performance).	7
CHAPTER III		
3.1	The schematic flow diagram of experimental equipment.	14
CHAPTER IV		
1	X-ray diffraction patterns for Au/MnO _x catalyst calcined at different temperatures.	44
2	Size distribution of Au crystallite for Au/MnO _x catalyst with different Au/Mn atomic ratios.	45
3	X-ray diffraction patterns for Au/FeO _x catalyst calcined at different temperatures.	46
4	TEM image for Au/MnO _x catalyst calcined at 300°C, atomic ratio of 1/30.	47
5	TEM image for Au/FeO _x catalyst calcined at 400°C, atomic ratio of 1/30.	48
6	TGA result for Au/MnO _x catalyst.	49
7	TGA result of Au/FeO _x catalyst.	50
8	Effect of pretreatment condition on Au/MnO _x catalyst calcined at 200°C, atomic ratio of 1/120.	51
9	Effect of pretreatment condition on Au/FeO _x catalyst calcined at 400°C, atomic ratio of 1/60.	52
10	Effect of calcination temperature on Au/MnO _x catalyst, He pretreatment, atomic ratio of 1/120.	53

11	Effect of calcination temperature on Au/FeO _x catalyst, O ₂ pretreatment, atomic ratio of 1/30.	54
12	Effect of Au loading on Au/MnO _x catalyst calcined at 300°C, He pretreatment.	55
13	Effect of Au loading on Au/FeO _x catalyst calcined at 400°C, O ₂ pretreatment.	56
14	Effect of CO ₂ on Au/MnO _x catalyst, calcined at 300°C , He pretreatment, atomic ratio of 1/30.	57
15	Effect of CO ₂ on Au/FeO _x catalyst, calcined at 400°C , O ₂ pretreatment, atomic ratio of 1/30.	58
16	Effect of H ₂ O on Au/MnO _x catalysts, calcined at 300°C , He pretreatment, atomic ratio of 1/30.	59
17	Effect of H ₂ O on Au/FeO _x catalysts, calcined at 400°C , O ₂ pretreatment, atomic ratio of 1/30.	60
18	Deactivation test of Au/MnO _x catalyst, calcined at 300°C, He pretreatment, atomic ratio of 1/30.	61
19	Deactivation test of Au/FeO _x catalyst, calcined at 400°C, O ₂ pretreatment, atomic ratio of 1/30.	62
20	A comparative study of Au/MnO _x catalyst.	63
21	A comparative study of Au/FeO _x catalyst.	64