

**HYDROGEN PRODUCTION BY AUTOTHERMAL SYSTEM:
CATALYST STUDIES**

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
and Case Western Reserve University

2002

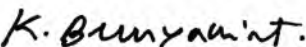
ISBN 974-03-1557-7

- 4 U.S. 2550

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Thesis Title: Hydrogen Production by Autothermal System: Catalyst Studies
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Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfillment of the requirements for the Degree of Master of Science.

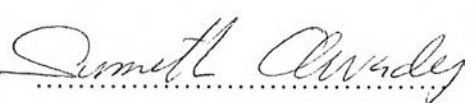

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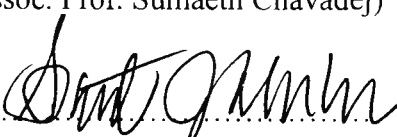
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บทคัดย่อ

อนันตริ จิตรานนท์ : การศึกษาการผลิตไฮโดรเจนโดยระบบความร้อนที่ได้ด้วยตัวเอง โดยศึกษาตัวเร่งปฏิกิริยา (Hydrogen Production by Autothermal System: Catalyst Studies) อาจารย์ที่ปรึกษา: ศ. โจฮานเนส ชววงค์, ผศ.ดร. ธีรศักดิ์ ฤกษ์สมบูรณ์ และ ผศ.ดร. วิษณุ มีอยู่ 61 หน้า ISBN 974-03-1557-7

งานวิจัยนี้ศึกษาการผลิตก๊าซไฮโดรเจนผ่านระบบความร้อนที่ได้ด้วยตัวเองซึ่งรวมเอา ระบบ partial oxidation และระบบ steam reforming ไว้ในเครื่องปฏิกรณ์เดียวกันเพื่อเพิ่มประสิทธิภาพการใช้พลังงาน โดยความร้อนที่เกิดจากระบบ partial oxidation จะส่งไปยังระบบ steam reforming ในขณะที่ตัวเร่งปฏิกิริยาที่เกิดขึ้นจะถูกกำจัดโดยก๊าซออกซิเจน เนื่องจากนิเกิลบนตัวรองรับซีเรียม/เซอร์โคเนียมออกไซด์เป็นตัวเร่งปฏิกิริยาที่ส่งเสริมปฏิกิริยา steam reforming และ water-gas shift จึงเหมาะที่จะเป็นตัวเร่งปฏิกิริยาสำหรับระบบความร้อนที่ได้ด้วยตัวเอง ในงานวิจัยนี้เป็นการศึกษาผลของการเติมตัวเร่งปฏิกิริยานิเกิลบนตัวรองรับซีเรียม/เซอร์โคเนียมออกไซด์ โดยแปรปริมาณของนิเกิลตั้งแต่ 5 ถึง 15 เปอร์เซ็นต์โดยน้ำหนัก ซึ่งใช้ทั้งวิธี sol-gel และวิธี impregnation ในการเตรียมตัวเร่งปฏิกิริยา จากการทดลองพบว่า $15\%Ni/Ce_{0.75}Zr_{0.25}O_2$ ของสองวิธีมีประสิทธิภาพดีที่สุดสำหรับปฏิกิริยา iso-octane oxidation และผลจากการศึกษาระบบความร้อนที่ได้ด้วยตัวเองกับตัวเร่งปฏิกิริยา $15\%Ni/Ce_{0.75}Zr_{0.25}O_2$ พบว่า อัตราส่วนระหว่างไฮโดรเจนต่อคาร์บอนมอนอกไซด์จะเพิ่มขึ้นเมื่อเพิ่มความเข้มข้นของไอน้ำและออกซิเจนเทียบกับความเข้มข้นของคาร์บอน

ABSTRACT

4371001063: PETROCHEMICAL TECHNOLOGY PROGRAM

Anantri Chitranont: Hydrogen Production by Autothermal System:
Catalyst Studies.

Thesis Advisors: Prof. Johannes Schwank, Asst. Prof. Thirasak
Rirksomboon, and Asst. Prof. Vissanu Meeyoo, 61 pp.

ISBN 974-03-1557-7

Keywords: Hydrogen Production/ Steam Reforming/ Autothermal System/ Sol-
Gel/Impregnation/ Ce/Zr Mixed Oxides/ Nickel

Autothermal system is an alternative system for producing hydrogen using a combination of partial oxidation and steam reforming in a single reactor. For efficient energy utilization, heat generated from partial oxidation will be provided for the steam reforming reaction whereas coke formation can be eliminated in the presence of O_2 . In a previous study, Ni/Ce_{0.75}Zr_{0.25}O₂ catalyst was found to be a promising candidate for both partial oxidation and steam reforming, thus it would be beneficial for use in the autothermal system. To further investigate the significance of Ni loading, the amount of Ni added over Ce_{0.75}Zr_{0.25}O₂ catalyst was varied from 5 to 15 wt%. The catalysts were prepared by two conventional methods, i.e. impregnation and sol-gel methods. It was found that the 15%Ni/Ce_{0.75}Zr_{0.25}O₂ catalyst exhibited the highest catalytic activity regardless of the method of preparation. Autothermal system studies of the effects of H₂O/C and O₂/C ratios on 15%Ni/Ce_{0.75}Zr_{0.25}O₂ showed that the H₂/CO ratio increased with increasing H₂O/C and O₂/C ratios.

ACKNOWLEDGEMENTS

First of all I would like to sincerely thanks Asst. Prof. Thirasak Rirksomboon and Asst. Prof. Vissanu Meeyoo for their useful advice, knowledge and recommendation throughout the course of this work.

Special thanks to all of the Petroleum and Petrochemical College's staff for their help and my acknowledgment is forwarded to Mr. Siriphong Roatluechai for his help and suggestion.

Finally, I would like to express my gratitude to my family and my friend for their love, help, encouragement and understanding.

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 Steam Reforming	2
	1.2 Partial Oxidation	4
II	LITERATURE SURVEY	5
	2.1 Autothermal System	5
	2.2 Catalysts	8
	2.3 Coke formation	12
III	EXPERIMENTAL	14
	3.1 Materials	14
	3.2 Catalyst Preparation	14
	3.2.1 Preparation of $Ce_{0.75}Zr_{0.25}O_2$ Support Catalyst	15
	3.2.2 Sol-gel Technique	15
	3.2.3 Impregnation Technique	16
	3.3 Catalyst Characterization	16
	3.3.1 BET Surface Area	16
	3.3.2 X-ray Diffraction Method	17
	3.3.3 Temperature Programmed Reduction	18

CHAPTER	PAGE
3.3.4 Transmission Electron Microscopy	18
3.4 Experimental Apparatus	18
3.4.1 Gas Mixing Section	19
3.4.2 Catalyst Reactor	19
3.4.3 Gas Analytical Instrument	19
3.5 Experimental Section	21
3.5.1 Catalyst Testing	21
3.5.2 The Effect of Steam/Carbon Ratio and Temperature	21
3.5.3 The Effect of Oxygen/Carbon Ratio and Temperature	22
3.5.4 Coke Formation Study	22
3.5.5 Catalyst Bed Temperature Profile	23
 IV RESULTS AND DISCUSSION	 24
4.1 BET Surface Area	24
4.1.1 BET Surface Area	24
4.1.2 X-ray Diffraction Method	25
4.1.3 Temperature Programmed Reduction	28
4.1.4 Transmission Electron Microscopy	31
4.2 Light Off Temperature	34
4.2.1 The Effect of Ni Loading Over $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ By Sol-Gel Method	34
4.2.2 The Effect of Ni Loading Over $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ By Impregnation Method	35
4.2.3 The Effect of Loading Method Over $15\%\text{Ni}/\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$	35
4.2.4 The Effect of O_2/C on Light Off Temperature Over $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ and $15\%\text{Ni}/\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ Prepared By Both Sol-gel and Impregnation Method	37

CHAPTER		PAGE
	4.3 The Effect of Steam/Carbon Ratios	41
	4.3.1 The Effect of Steam/Carbon Ratio Over Support Loaded By Sol-gel Method	41
	4.3.2 The Effect of Steam/Carbon Ratios Over Support Loaded By Impregnation Method	42
	4.4 The Effect of Oxygen/Carbon Ratios	46
	4.4.1 The Effect of Oxygen/Carbon Ratios Over Support Loaded By Sol-gel Method	46
	4.4.2 The Effect of Oxygen/Carbon Ratios Over Support Loaded By Impregnation Method	47
	4.5 Coke Formation Study	51
	4.5.1 Temperature Programmed Oxidation	51
	4.5.2 Transmission Electron Microscopy	53
	4.5.3 Catalyst Decomposition	53
	4.6 Catalyst Bed Temperature Profile	55
V	CONCLUSION AND RECOMMENDATIONS	57
	5.1 Conclusion	57
	5.2 Recommendations	58
	REFERENCES	59
	CURRICULUM VITAE	61

LIST OF TABLES

TABLE		PAGE
4.1	BET surface area measurements for all fresh catalysts	24
4.2	Pore volume and pore size of all fresh catalysts	25

LIST OF FIGURES

FIGURE	PAGE
2.1 Schematic of autothermal reformer	6
3.1 Schematic of the experimental apparatus	20
4.1 XRD patterns of 5%, 10% and 15% Ni over $Ce_{0.75}Zr_{0.25}O_2$ prepared by sol-gel method in comparison with $Ce_{0.75}Zr_{0.25}O_2$; (●) CeO_2	26
4.2 XRD patterns of 5%, 10% and 15% Ni over $Ce_{0.75}Zr_{0.25}O_2$ prepared by impregnation method in comparison with $Ce_{0.75}Zr_{0.25}O_2$; (●) CeO_2 , (■) NiO	27
4.3 CO TPR results of $Ce_{0.75}Zr_{0.25}O_2$ (a), 5%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ (b), 10%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ (c) and 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ (d) which prepared by sol-gel method	29
4.4 CO TPR results of $Ce_{0.75}Zr_{0.25}O_2$ (e), 5%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ (f), 10%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ (g) and 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ (h) which prepared by impregnation method	29
4.5 CO TPR results of 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ which prepared sol-gel (a) and impregnation method (b)	30
4.6 TEM pictures of Ni loading on $Ce_{0.75}Zr_{0.25}O_2$ by sol-gel method with 5%Ni (a), 10%Ni (b) and 15%Ni (c)	32
4.7 TEM pictures of Ni loading on $Ce_{0.75}Zr_{0.25}O_2$ by impregnation method with 5%Ni (d), 10%Ni (e) and 15%Ni (f)	33
4.8 Iso-octane conversion as a function of reaction temperatures over different nickel loading on $Ce_{0.75}Zr_{0.25}O_2$ by sol-gel method; %Ni loadings: (■) 0, (●) 5, (◆) 10 and (▲) 15 with reaction condition: O_2/C ratio = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	34

FIGURE	PAGE
4.9 Iso-octane conversion as a function of reaction temperatures over different nickel loading on $Ce_{0.75}Zr_{0.25}O_2$ by impregnation method; %Ni loadings: (■) 0, (●) 5, (◆) 10 and (▲) 15 with reaction condition: O_2/C ratio = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	36
4.10 Iso-octane conversion as a function of reaction temperatures on 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$; %Ni loading methods: (■) sol-gel method and (●) impregnation method with reaction condition: O_2/C ratio = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	37
4.11 Selectivity of CO_2 , CO and H_2 product from iso-octane oxidation over 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ prepared by sol-gel method; (◆) CO_2 , (■) CO and (▲) H_2 with reaction condition: O_2/C ratio = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	38
4.12 Selectivity of CO_2 , CO and H_2 product from iso-octane oxidation over 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ prepared by impregnation method; (◆) CO_2 , (■) CO and (▲) H_2 with reaction condition: O_2/C ratio = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	38
4.13 The effect of O_2/C on Light Off temperature of iso-octane oxidation over $Ce_{0.75}Zr_{0.25}O_2$; O_2/C ratios: (■) 0.125/1, (●) 0.25/1, (◆) 0.50/1 and (▲) 1/1 with reaction condition: total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	39
4.14 The effect of O_2/C on Light Off temperature of iso-octane oxidation over 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ prepared by sol-gel method; O_2/C ratios: (■) 0.125/1, (●) 0.25/1, (◆) 0.50/1 and (▲) 1/1 with reaction condition: total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	39
4.15 The effect of O_2/C on Light Off temperature of iso-octane oxidation over 15%Ni/ $Ce_{0.75}Zr_{0.25}O_2$ prepared by impregnation method; O_2/C ratios: (■) 0.125/1, (●) 0.25/1, (◆) 0.50/1 and (▲) 1/1 with reaction condition: total flow rate = 160 ml/min and space velocity = 64,000 h^{-1}	39

FIGURE	PAGE
4.16 The effect of H ₂ O/C ratios on H ₂ /CO product ratio at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by sol-gel method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	43
4.17 The effect of H ₂ O/C ratios on CO selectivity at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by sol-gel method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	43
4.18 The effect of H ₂ O/C ratios on conversion at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by sol-gel method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	44
4.19 The effect of H ₂ O/C ratios on H ₂ /CO product ratio at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by impregnation method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	44
4.20 The effect of H ₂ O/C ratios on CO selectivity at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by impregnation method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	45
4.21 The effect of H ₂ O/C ratios on conversion at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by impregnation method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	45

FIGURE	PAGE
4.22 The effect of O ₂ /C ratios on H ₂ /CO product ratio at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by sol-gel method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	48
4.23 The effect of O ₂ /C ratios on CO selectivity at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by sol-gel method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	48
4.24 The effect of O ₂ /C ratios on conversion at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by sol-gel method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	49
4.25 The effect of O ₂ /C ratios on H ₂ /CO product ratio at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by impregnation method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	49
4.26 The effect of O ₂ /C ratios on CO selectivity at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by impregnation method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	50
4.27 The effect of O ₂ /C ratios on conversion at (■) 450°C, (●) 500°C, (◆) 550°C and (▲) 600°C of 15%Ni/Ce _{0.75} Zr _{0.25} O ₂ by impregnation method with reaction condition: O ₂ /C = 1/1, total flow rate = 160 ml/min and space velocity = 64,000 h ⁻¹	50

FIGURE	PAGE
4.28 TPO results of $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (a) , 5%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (b), 10%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (c) and 15%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (d) which prepared by sol-gel method	52
4.29 TPO results of $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (e) , 5%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (f), 10%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (g) and 15%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ (h) which prepared by impregnation method	52
4.30 TEM results of used 15%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ which prepared by sol-gel method (a) and impregnation method (b)	54
4.31 The activity of 15%Ni/ $\text{Ce}_{0.75}\text{Zr}_{0.25}\text{O}_2$ versus time for coke formation study carried under autothermal system with reaction condition: $\text{O}_2/\text{C} = 1/1$, total flow rate = 160 ml/min and space velocity = $64,000 \text{ h}^{-1}$	54
4.32 Catalyst bed temperature profiles measured at the furnace set-point of 600°C for steam reforming (■), partial oxidation (◆) and autothermal system (●); the temperature difference refers to the measured bed temperature minus the furnace set-point temperature	56