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**EFFECTS OF La- AND Ba- BASED PEROVSKITES COATED
ON PEROVSKITE MEMBRANES ON OXYGEN PERMEATION**



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ศูนย์วิทยทรัพยากร
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A Thesis Submitted in Partial Fulfillment of the Requirements
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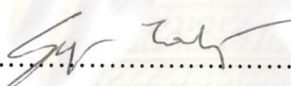
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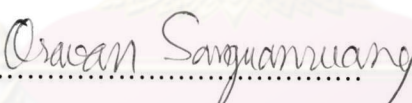
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การปรับปรุงพื้นผิวหน้าเมมเบรนเพอรอฟสไกต์ให้มีความเป็นรูพรุนด้วยสารประกอบ
เพอรอฟสไกต์ชนิด $La_{1-x}Sr_xCoO_{3-\delta}$, $La_{1-x}Sr_xFeO_{3-\delta}$, $Ba_{1-x}Sr_xCoO_{3-\delta}$, และ $Ba_{1-x}Sr_xFeO_{3-\delta}$ หรือเขียน
เป็นตัวย่อว่า LSC, LSF, BSC, และ BSF ตามลำดับ เมื่อสัดส่วนของสตรอนเตียม (x) = 0.2 - 0.6 ซึ่ง
สังเคราะห์ด้วยวิธีซึทเทรตประยุกต์ศึกษาปริมาณสตรอนเตียมที่มีต่อลักษณะโครงสร้างผลึกของ
สารประกอบเพอรอฟสไกต์ และภาวะที่เหมาะสมในการเผื่อการเปลี่ยนแปลงเป็นโครงสร้างผลึก
เดี่ยวที่อุณหภูมิ 800-1,000 °C ผงเพอรอฟสไกต์ที่เตรียมได้นำไปทำให้อยู่ในรูปของของเหลวหนืด
เคลือบของผสมดังกล่าวลงบนแผ่นเมมเบรนชนิด $La_{0.8}Sr_{0.2}Co_{0.6}Fe_{0.4}O_{3-\delta}$, $La_{0.6}Sr_{0.4}Ga_{0.3}Fe_{0.7}O_{3-\delta}$,
และ $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ หรือเขียนเป็นตัวย่อว่า LSCF8264, LSGF6437, และ BSCF5582
ตามลำดับ ด้วยวิธีการทาสกรีน โดยทำการเคลือบลงไปบนทั้งสองด้านของแผ่นเมมเบรน และทำ
การเคลือบซ้ำ ทั้งหมดสองครั้ง จากนั้นนำแผ่นเมมเบรนที่เคลือบแล้วไปเผาซินเทอร์ที่อุณหภูมิ 800-
1,100 °C เป็นเวลา 5 ชั่วโมง ตรวจสอบโครงสร้างผลึกของผงเพอรอฟสไกต์ และแผ่นเมมเบรนที่
เคลือบแล้วด้วยเทคนิค การตรวจสอบลักษณะอนุภาคของแผ่นเมมเบรนที่เคลือบแล้ว ทำโดยเทคนิค
SEM พบว่า ลักษณะพื้นผิวหน้าของแผ่นเมมเบรนมีความเป็นรูพรุน ที่ภาวะการเผาที่อุณหภูมิ
1,000 °C ศึกษาความสามารถในการคายการดูดซับก๊าซออกซิเจนของสารประกอบเพอรอฟสไกต์
ด้วยเทคนิค TGA และ O_2 -TPD พบว่าสารประกอบเพอรอฟสไกต์ชนิด BSF55 มีปริมาณการคาย
การดูดซับก๊าซออกซิเจนสูงที่สุด เท่ากับ 2.192 % ซึ่งสอดคล้องกับผลการทดลองที่ได้จาก O_2 -TPD
ซึ่งจากทฤษฎี คาดว่าสารประกอบเพอรอฟสไกต์ BSF 55 เคลือบบนแผ่นเมมเบรน BSCF5582 จะ
ให้อัตราการแพร่ของก๊าซออกซิเจนสูงที่สุด

สาขาวิชา ปิโตรเคมีและวิทยาศาสตร์พอลิเมอร์ ลายมือชื่อนิสิต.....^{สิริกานดา นवलแสง}
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SIRIKANDA NOUNSANG : EFFECTS OF La- AND Ba- BASED
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The surface modification of substrate perovskite membranes with a porous layer was performed by coating of the catalytic perovskite compounds: $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$, $\text{La}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$, $\text{Ba}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$, and $\text{Ba}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ or abbreviated as LSC, LSF, BSC, and BSF, respectively where $x = 0.2 - 0.6$. These perovskites were synthesized by a modified citrate method. Amount of strontium (x) affecting the crystalline structure of the perovskite compounds were studied. The catalytic perovskite layer was coated on both surfaces of the sintered membrane by a screen-printing method and repeated twice. Post heat treatment was conducted to control the porosity of the coating layer at 800-1,100 °C. The substrate membranes were using $\text{La}_{0.8}\text{Sr}_{0.2}\text{Co}_{0.6}\text{Fe}_{0.4}\text{O}_{3-\delta}$, $\text{La}_{0.6}\text{Sr}_{0.4}\text{Ga}_{0.3}\text{Fe}_{0.7}\text{O}_{3-\delta}$, and $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Co}_{0.8}\text{Fe}_{0.2}\text{O}_{3-\delta}$ or abbreviated as LSCF8264, LSGF6437, and BSCF5582. The formation of catalytic perovskite powders and coated membrane were confirmed by XRD. The morphology of the coated membranes was investigated by SEM. The results indicated that in the sinter temperature at 1,000 °C, the porous layer was formed. The oxygen desorption of the perovskite compounds were determined by TGA and O₂-TPD. Experimental results of TGA indicated that the amount of oxygen desorbed from the BSF55 catalyst is higher (2.192 %) than that of the other catalytic compounds. By introducing a highly oxygen desorbed BSF55 coating on the BSCF5582 membrane, significant promotion in the oxygen permeation fluxes could be obtained.

Field of study Petrochemistry and Polymer Science Student's signature SIRIKANDA NOUNSANG
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CONTENTS

	Page
ABSTRACT IN THAI.....	iv
ABSTRACT IN ENGLISH.....	v
ACKNOWLEDGEMENTS.....	vi
CONTENTS.....	vii
LIST OF FIGURES.....	xi
LIST OF SCHEMES.....	xiv
LIST OF TABLES.....	xv
LIST OF ABBREVIATIONS.....	xvi
CHAPTER I INTRODUCTION.....	1
1.1 The objective of the thesis.....	3
1.2 The scope of the thesis.....	3
CHAPTER II THEORY AND LITTERATURE REVIEWS...	5
2.1 Structure of perovskite.....	5
2.1.1 Crystal structure.....	5
2.1.2 Nonstoichiometry in perovskite.....	7
2.2 Physical properties.....	7
2.3 Perovskite synthesis.....	8
2.3.1 Solution reaction.....	8
2.3.2 Solid state reaction.....	9
2.3.3 Gas phase reaction.....	9
2.4 Perovskite membrane preparation.....	10
2.4.1 Wet chemical synthesis of perovskite.....	10
2.4.2 Powder sizing.....	13
2.4.3 Powder compacting by uniaxial pressing.....	13
2.4.4 Sintering.....	14
2.5 Perovskite membrane concepts.....	15

	Page
2.5.1 Dense perovskite membranes for oxygen separation.....	15
2.5.2 Oxygen permeation through a mixed ionic-electronic conducting membrane.....	16
2.5.3 Coated disc membrane reactor.....	20
2.6 Oxygen permeation study and property of dense perovskite membrane.....	22
2.7 Effect of A-site or B-site substituted on the ABO_3 perovskite structure.....	23
2.8 Effect of temperature on crystal structure development....	24
2.9 Oxygen content determination in perovskite by using thermogravimetric analysis.....	26
CHAPTER III EXPERIMENTAL	28
3.1 Chemicals.....	28
3.2 Preparations of perovskite powders by modified citrate method.....	29
3.3 Perovskite membrane preparation.....	33
3.4 Preparation of slurry coating compounds.....	33
3.5 Screen printing method.....	34
3.6 Characterization of the perovskite oxide.....	35
3.2.1 X-ray diffractometer (XRD).....	35
3.2.2 Scanning electron microscope (SEM).....	35
3.2.3 Temperature-programmed desorption of oxygen (O_2 -TPD).....	35
3.2.4 Thermogravimetric analysis (TGA).....	36

	Page
CHAPTER IV RESULTS AND DISCUSSION	37
4.1 Tolerance number of perovskite compounds.....	37
4.2 Characterization of the perovskite compounds.....	38
4.2.1 X-ray diffraction (XRD).....	38
4.2.1.1 The substrate compounds.....	38
4.2.1.2 The catalytic perovskite compounds.....	41
A. $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ (x=0.2-0.6) perovskite compounds.....	41
B. $\text{La}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ (x=0.2-0.6) perovskite compounds.....	43
C. $\text{Ba}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ (x=0.2-0.6) perovskite compounds.....	44
D. $\text{Ba}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ (x=0.2-0.6) perovskite compounds.....	46
4.2.1.3 The influence of calcinations temperature on phase purification.....	47
4.2.1.4 Crystal structure unit cell and crystalline phase analysis.....	48
A. Crystalline phase analysis of $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ (x=0.2-0.6).....	48
B. Crystalline phase analysis of $\text{La}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ (x=0.2-0.6).....	50
C. Crystalline phase analysis of $\text{Ba}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ (x=0.2-0.6).....	51
D. Crystalline phase analysis of $\text{Ba}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ (x=0.2-0.6).....	53
4.2.1.5 Characterization of coated membrane.....	54
4.2.2 Scanning electron microscope (SEM).....	55

	Page
4.2.2.1 The effect of sintering temperature on coated membrane.....	55
4.2.2.2 The coated membranes (BSCF5582, LSCF8264, and LSGF6437) with various catalytic perovskite compounds.....	59
A. $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF5582) membrane..	59
B. $La_{0.8}Sr_{0.2}Co_{0.6}Fe_{0.4}O_{3-\delta}$ (LSCF8264) membrane..	61
C. $La_{0.6}Sr_{0.4}Ga_{0.3}Fe_{0.7}O_{3-\delta}$ (LSGF6437) membrane..	63
4.3 The oxygen desorption studied.....	63
4.3.1 Thermogravimetric analysis (TGA).....	63
4.3.2 Temperature program desorption of oxygen (O_2 -TPD).	66
4.3.2.1 The O_2 -TPD of the substrate perovskite compounds.....	66
4.3.2.2 The O_2 -TPD of the catalytic perovskite compounds.....	68
CHAPTER VI CONCLUSION AND SUGGESTION.....	73
REFERENCES.....	75
APPENDICES.....	82
VITAE.....	93

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

LIST OF FIGURES

		Page
Figure 2.1	ABO ₃ ideal perovskite structure showing oxygen octahedron containing the B ion linked through corners to form a three-dimensional cubic lattice.....	5
Figure 2.2	Surveys of oxygen flux and reactions in mixed-conducting membrane reactors.....	16
Figure 2.3	The principle in a MIEC membrane at various zones during steady state oxygen permeation. The curve shows a possible P_{O_2} profile over the membrane. A single prime indicates air side, double prime indicates permeate side.....	18
Figure 2.4	Experimental apparatus for gas-flow arrangement in oxygen permeation flux measuring system.....	21
Figure 2.5	SEM picture of a coated 30%LSC support; the coating was sintered at 1100 °C.....	22
Figure 2.6	Increase of oxygen vacancy concentration (δ) with temperature increase in oxygen and nitrogen flow.....	27
Figure 3.1	Diagrams of the screen printing process and printing frame.....	34
Figure 4.1	XRD pattern of LSCF8264 perovskite compound.....	39
Figure 4.2	XRD pattern of LSGF6437 perovskite compound.....	40
Figure 4.3	XRD pattern of BSCF5582 perovskite compound.....	40
Figure 4.4	XRD patterns of La _{1-x} Sr _x CoO _{3-δ} (x = 0.2-0.6) catalytic perovskite compounds after calcinated temperature.....	42
Figure 4.5	XRD patterns of La _{1-x} Sr _x FeO _{3-δ} (x = 0.2-0.6) catalytic perovskite compounds after calcinated temperature.....	44
Figure 4.6	XRD patterns of Ba _{1-x} Sr _x CoO _{3-δ} (x = 0.2-0.6) catalytic perovskite compounds after calcinated temperature.....	45

	Page
Figure 4.7 XRD patterns of $Ba_{1-x}Sr_xFeO_{3-\delta}$ ($x = 0.2-0.6$) catalytic perovskite compounds after calcinated temperature.....	47
Figure 4.8 XRD patterns of LSC64 catalytic perovskite compound were varies calcination temperatures.....	48
Figure 4.9 Characteristic splitting of the cubic (110) into the (110) and (104) reflections of the orthorhombic cell during X-ray analysis of LSC.....	49
Figure 4.10 XRD patters of $La_{1-x}Sr_xFeO_{3-\delta}$ showing the 2θ region $56^\circ-60^\circ$...	50
Figure 4.11 Powder XRD patterns for hexagonal unit cell of $Ba_{1-x}Sr_xCoO_{3-\delta}$ ($x=0.2-0.6$)	52
Figure 4.12 X-ray diffraction data of BSF showing the 2θ region $31^\circ-36^\circ$	53
Figure 4.13 XRD patterns of pure and coated membrane. (a) Pure LSC64 powder; (b) coated membrane; (c) Pure BSCF5582 powder.....	54
Figure 4.14 SEM pictures of top view of LSC 64 layer coat on LSCF 8264 membrane sintered at (a) $800^\circ C$, 5h. (b) $1000^\circ C$, 5h. (c) $1100^\circ C$, 5h.....	56
Figure 4.15 SEM pictures of top view of LSC 64 layer coat on BSCF 5582 membrane sintered at (a) $800^\circ C$, 5h. (b) $1000^\circ C$, 5h. (c) $1100^\circ C$, 5h.....	57
Figure 4.16 SEM picture of top view of LSC 64 layer coat on LSGF 6437 membrane sintered at (a) $800^\circ C$, 5h. (b) $1000^\circ C$, 5h. (c) $1100^\circ C$, 5 h.....	57
Figure 4.17 SEM pictures of top view of LSC 64 layer coat on BSCF 5582 membrane sintered $1000^\circ C$, 5h. (a) top view (b) cross section..	58
Figure 4.18 SEM picture of top view of LSF 73 layer coat on BSCF 5582 membrane sintered at $1000^\circ C$, 5 h. (a) and cross section (b).....	58
Figure 4.19 SEM picture of top view of BSC 55 layer coat on BSCF 5582 membrane sintered at $1000^\circ C$, 5h.(a) and (b) cross section.....	58
Figure 4.20 SEM picture of top view of BSF 55 layer coat on BSCF 5582 membrane sintered at $1000^\circ C$, 5h. (a) and (b) cross section.....	59

	Page
Figure 4.21 SEM picture of top view of BSCF 5582 membrane coated by LSC 64, LSC 55, and LSC 46 sintered at 1000 °C, 5h.....	59
Figure 4.22 SEM picture of top view of BSCF 5582 membrane coated by LSF 82 and LSF 73 sintered at 1000 °C, 5h.....	60
Figure 4.23 SEM picture of top view of BSCF 5582 membrane coated by BSC 64, BSC 55, and BSC 46 sintered at 1000 °C, 5h.....	60
Figure 4.24 SEM picture of top view of BSCF 5582 membrane coated by BSF 82, BSF 73, BSF 64, and BSF 55 layer sintered at 1000 °C, 5h.....	61
Figure 4.25 SEM picture of top view of LSCF 8264 membrane coated by LSC 64, LSC 55, and LSC 46 layer sintered at 1000 °C, 5h.....	61
Figure 4.26 SEM picture of top view of LSCF 8264 membrane coated by LSF 82 and LSF 73 layer sintered at 1000 °C, 5h.....	62
Figure 4.27 SEM picture of top view of LSCF 8264 membrane coated by BSC 64, BSC 55, and BSC 46 layer sintered at 1000 °C, 5h.....	62
Figure 4.28 SEM picture of top view of LSCF 8264 membrane coated by BSF 82, BSF 73, BSF 64, and BSF 55 layer sintered at 1000 °C, 5h.....	62
Figure 4.29 SEM picture of top view of LSGF 6437 membrane coated by LSC 64, LSC 55, and LSC 46 layer sintered at 1000 °C, 5h.....	63
Figure 4.30 SEM picture of top view of LSGF 6437 membrane coated by LSF 82 and LSF 73 layer sintered at 1000 °C, 5h.....	63
Figure 4.31 TGA curve of Ba _{0.5} Sr _{0.5} FeO _{3-δ} (BSF55) powder.....	64
Figure 4.32 The O ₂ -TPD profiles of the substrate perovskite compounds: (a) LSCF8264, (b) LSGF6437, and (c) BSCF5582.....	68
Figure 4.33 O ₂ -TPD profiles over La _{1-x} Sr _x CoO _{3-δ} (x=0.4-0.6).....	69
Figure 4.34 O ₂ -TPD profiles over La _{1-x} Sr _x FeO _{3-δ} (x=0.2-0.3).....	70
Figure 4.35 O ₂ -TPD profiles over Ba _{1-x} Sr _x CoO _{3-δ} (x=0.4-0.6).....	71
Figure 4.36 O ₂ -TPD profiles over Ba _{1-x} Sr _x FeO _{3-δ} (x=0.2-0.5).....	72

LIST OF SCHEMES

	Page
Scheme 2.1 Mechanism of sintering.....	14
Scheme 2.2 Mechanism of the mixed ion-electron conducting membranes..	16



ศูนย์วิจัยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

LIST OF TABLES

		Page
Table 3.1	Reagents for synthesis of perovskites.....	28
Table 3.2	Reagents for preparation of slurry coating compounds.....	29
Table 3.3	Stoichiometric amounts of metal nitrates based on 0.02 mole of perovskite.....	31
Table 3.4	The compositions of slurry coating.....	34
Table 4.1	Tolerance number of prepared perovskites.....	37
Table 4.2	Existence of the single phase of substrate perovskite compounds.....	38
Table 4.3	Existence of the phase observed of $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$	41
Table 4.4	Existence of the phase observed of $\text{La}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$	43
Table 4.5	Existence of the phase observed of $\text{Ba}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$	44
Table 4.6	Existence of the phase observed of $\text{Ba}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$	46
Table 4.7	Unit cell data from XRD at room temperature for $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ ($x=0.2-0.6$).....	49
Table 4.8	Unit cell data from XRD at room temperature for $\text{La}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ ($x=0.2-0.6$).....	50
Table 4.9	Unit cell data from XRD at room temperature for $\text{Ba}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ ($x=0.2-0.6$).....	52
Table 4.10	Unit cell data from XRD at room temperature for $\text{Ba}_{1-x}\text{Sr}_x\text{FeO}_{3-\delta}$ ($x=0.2-0.6$).....	53
Table 4.11	TGA data of the perovskite compounds.....	64

LIST OF ABBRIVIATIONS

δ	Non-stoichiometry of oxygen in mole formula
σ_e	Electronic conductivity
σ_i	Ionic conductivity
σ_{tot}	Electrical conductivity
BSCF	Perovskite containing Ba, Sr, Co, and Fe
BSC	Perovskite containing Ba, Sr, and Co
BSF	Perovskite containing Ba, Sr, and Fe
c	Cubic
$^{\circ}\text{C}$	Degree celsius
DBP	Dibutyl phthalate
EDTA	Ethylene diamine tetraacetic acid
LSC	Perovskite containing La, Sr, and Co
LSF	Perovskite containing La, Sr, and Fe
LSCF	Perovskite containing La, Sr, Co, and Fe
LSGF	Perovskite containing La, Sr, Ga, and Fe
MIECM	Mixed ionic-electronic conducting membrane
min	Minute (s)
o	Orthorhombic
$\text{O}_2\text{-TPD}$	Temperature program desorption of oxygen
P'_{O_2}	Partial pressure of oxygen at higher pressure
P''_{O_2}	Partial pressure of oxygen at lower pressure
PEG	Polyethylene glycol
POM	Partial Oxidation of Methane
PVA	Polyvinyl alcohol
r	Rhombohedral
$r_{\text{La}^{3+}}$	Ionic radius of lanthanum
$r_{\text{Sr}^{2+}}$	Ionic radius of strontium
$r_{\text{Ba}^{2+}}$	Ionic radius of barium
SEM	Scanning Electron Microscope
t	Tolerance number

TGA Thermogravimetric analysis
XRD X-ray diffraction



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