

**HYDROGEN STORAGE: EFFECT OF CATALYSTS
ON HYDROGEN DESORPTION/ABSORPTION
OF Li-N-H AND Li-Al-N-H SYSTEMS**

Ms. Somporn Thipmongkolsilp

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By: Ms. Somporn Thipmongkolsilp
Program: Petroleum Technology
Thesis Advisors: Assoc. Prof. Pramoch Rangsunvigit
Dr. Santi Kulprathipanja

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University, in partial fulfilment of the requirements for the Degree of Master of
Science.

Nantaya Yanumet
..... College Director
(Assoc. Prof. Nantaya Yanumet)

Thesis Committee:

Pramoch R.
.....
(Assoc. Prof. Pramoch Rangsunvigit)

Santi Kulprathipanja
.....
(Dr. Santi Kulprathipanja)

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

N. Muangsin
.....
(Assoc. Prof. Nongnuj Muangsin)

ABSTRACT

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This work explored the hydrogen storage capacity of Li-N-H and Li-Al-N-H systems; a mixture of lithium amide (LiNH_2) and lithium hydride (LiH) and a mixture of LiNH_2 and lithium aluminium hydrides (LiAlH_4). The hydrogen desorption/absorption capacity was observed through volumetric analysis. LiNH_2 and LiH were mixed by mortar and pestle and ball milling techniques with a small amount of Fe, Ni, ZrCl_4 , and TiO_2 while LiNH_2 and LiAlH_4 were doped with ZrCl_4 , TiO_2 , and VCl_3 mixed by ball milling. The hydrogen desorption was performed from room temperature to 200°C and hydrogen absorption was at 1500 psig and 180°C . The results showed that the transition metals and mixing means seemed to increase the hydrogen desorption capacity from the Li-N-H systems. The mixture of LiNH_2 and LiH doped with TiO_2 and mixed by agate ball mill gives the best result followed by those mixed with ZrCl_4 , Ni, and Fe, respectively. The amounts of released hydrogen are between 0.5 - 1.5 wt% and are not reversible. In the case of the mixture of LiNH_2 and LiAlH_4 , the hydrogen desorptions of the undoped samples are in range 2.5 - 5.0 wt% for the first cycle and they can increase up to 8.0 wt% when doped with catalysts. Moreover, the samples can be reversible about 0.15 - 0.4 wt%.

บทคัดย่อ

สมพร ทิพย์มั่งคณศิลป์: การศึกษาผลกระทบของโลหะต่อระบบลิเทียม-ไนโตรเจนไฮโดรเจน เพื่อใช้ในการเก็บก๊าซไฮโดรเจน (Hydrogen Storage: Effect of Catalysts on Hydrogen Desorption/Absorption of Li-N-H and Li-Al-N-H Systems) อ. ที่ปรึกษา: รศ. ดร. ปราโมช รังสรรค์วิจิตร และ ดร. สันติ กุลประทีปปัญญา 64 หน้า

งานวิจัยนี้ ศึกษาความสามารถในการเก็บก๊าซไฮโดรเจนของระบบลิเทียม-ไนโตรเจนไฮโดรเจน (Li-N-H) และลิเทียม-อะลูมิเนียม-ไนโตรเจนไฮโดรเจน (Li-Al-N-H) โดยเน้นไปที่สารผสมระหว่างลิเทียมเอไมด์ (LiNH_2) กับลิเทียมไฮไดรด์ (LiH) และสารผสมระหว่างลิเทียมเอไมด์ (LiNH_2) กับลิเทียมอะลูมิเนียมไฮไดรด์ (LiAlH_4) ที่ผ่านการบดและผสมด้วยโลหะชนิดต่างๆ เพื่อเพิ่มปริมาณการปลดปล่อยก๊าซไฮโดรเจน การวัดปริมาณก๊าซไฮโดรเจนในระบบทำโดยใช้เทคนิคการดูดซึม และการปลดปล่อยก๊าซที่ปริมาตรคงที่ ผลการทดลองพบว่าสารผสมระหว่างลิเทียมเอไมด์กับลิเทียมไฮไดรด์ผสมด้วยไททาเนียมไดออกไซด์ (TiO_2) สามารถปลดปล่อยก๊าซไฮโดรเจนได้สูงสุดที่ 1.5% โดยน้ำหนักไฮโดรเจน และไม่เกิดปฏิกิริยาผันกลับ ในขณะที่สารผสมระหว่างลิเทียมเอไมด์กับลิเทียมอะลูมิเนียมไฮไดรด์ปลดปล่อยก๊าซไฮโดรเจน ตั้งแต่ 2.5 – 5.0% โดยน้ำหนักสำหรับการปลดปล่อยครั้งแรก ทั้งนี้ขึ้นกับปริมาณลิเทียมอะลูมิเนียมไฮไดรด์ในสารผสม และเมื่อบดสารผสมรวมกับโลหะชนิดต่างๆ เช่น วานาเดียมไตรคลอไรด์ (VCl_3) หรือเซอโคเรเนียมเตตระคลอไรด์ (ZrCl_4) สามารถปลดปล่อยก๊าซไฮโดรเจนมากขึ้นถึง 8.0% โดยน้ำหนัก ยิ่งกว่านั้นข้อดีของสารผสมนี้ คือเกิดปฏิกิริยาผันกลับได้ โดยสามารถปลดปล่อยไฮโดรเจนในช่วง 0.15 – 0.4% โดยน้ำหนักสำหรับการปลดปล่อยครั้งต่อไป จากผลการทดลองแสดงให้เห็นว่าชนิดของโลหะ และวิธีการบด สามารถเพิ่มการปลดปล่อยไฮโดรเจนของระบบที่ศึกษา

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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
II BACKGROUND AND LITERATURE REVIEW	3
2.1 Hydrogen	3
2.2 Hydrogen Storage	3
2.2.1 Compressed Hydrogen Gas	3
2.2.2 Liquid Hydrogen Storage	3
2.2.3 Solid-State Storage	4
2.3 Metal Hydrides	6
2.3.1 Alkali Metal Hydrides	10
2.3.2 Inter-metallic Metal Hydride	11
2.4 Li-N-H and Li-Al-N-H System	12
III EXPERIMENTAL	16
3.1 Materials	16
3.1.1 Preparation of Nanoscale Iron Particle	16
3.2 Sample Preparation	17
3.3 Experimental Set-up	17
3.4 Hydrogen Sorption Data Collection	19

CHAPTER	PAGE
3.4.1 Desorption	19
3.4.2 Absorption	20
IV RESULTS AND DISCUSSION	22
4.1 Effect of Catalysts on Hydrogen Desorption in Li-N-H Systems	22
4.1.1 Mixed by Mortar and Pestle	22
4.1.2 Mixed by Agate Ball Milling	23
4.2 Effect of Mixing Means on Hydrogen Desorption in Li-N-H Systems	24
4.3 Effect of LiAlH ₄ on Hydrogen Desorption in LiNH ₂	27
4.4 Effect of Catalysts on Hydrogen Desorption in Li-Al-N-H Systems	30
4.4.1 Effect of Catalysts	30
4.4.2 Effect of ZrCl ₄ Loading	33
4.4.3 Reversibility of Li-Al-N-H Systems	34
4.4.4 Effect of Sample Loading Methods	35
4.5 TPD and MS of LiNH ₂ and LiNH ₂ /LiAlH ₄	40
4.5.1 Effect of Catalyst on LiNH ₂	40
4.5.2 Effect of LiAlH ₄ Loading	40
4.5.3 Effect of Catalysts on LiNH ₂ /LiAlH ₄	44
4.5.4 Effect of Two-Layered Packing Sample	46
V CONCLUSIONS AND RECOMMENDATIONS	47
5.1 Conclusions	47
5.2 Recommendations	48
REFERENCES	49

	PAGE
APPENDICES	52
APPENDIX A The Calculated Volume of the Manifold and Sample	52
APPENDIX B Hydrogen Capacities of Li-N-H and Li-Al-N-H Systems	54
APPENDIX C Changes of Pressure during the Dehydrogenation	56
 CURRICULUM VITAE	 64

LIST OF TABLES

TABLE		PAGE
2.1	Comparison of available types of hydrogen storage	5
2.2	Examples of alkali metal hydrides and their properties	10
2.3	Inter-metallic compounds	11
3.1	Compressibility factors at different temperature ranges	20

LIST OF FIGURES

FIGURE	PAGE
2.1 Model of the metal hydrides interaction	7
2.2 Absorption and desorption of metal hydrides	7
2.3 Potential energy of a hydrogen molecule and of two hydrogen atoms.	8
2.4 Pressure-concentration-temperature curve (PCT diagram) and van't Hoff plot (Logarithm of the equilibrium against the reciprocal temperature)	10
3.1 Schematic diagram of the experimental set-up	18
3.2 Schematic diagram of the actual set-up	18
4.1 Correlation between temperature and hydrogen released during hydrogen desorption from the mixture of LiNH_2 and LiH with 1:1 mol ratio by mortar and pestle for 15 min: a) 1 mol% TiO_2 , b) 1 mol% Fe, and c) undoped.	22
4.2 Correlation between temperature and hydrogen released during hydrogen desorption from the mixture of LiNH_2 and LiH with 1:1 mol ratio by using agate ball milling for 2 h: a) 1 mol% TiO_2 , b) 1 mol% ZrCl_4 , c) 1 mol% Ni, d) 1 mol% Fe, and e) undoped.	23
4.3 Correlation between temperature and hydrogen released during hydrogen desorption from the mixture of LiNH_2 and LiH with 1:1 mol ratio: a) 1 mol% TiO_2 by using agate ball milling for 2 h, b) 1 mol% TiO_2 by using mortar and pestle for 15 min, c) undoped by using agate ball milling for 2 h, and d) undoped by using mortar and pestle for 15 min.	24

- 4.4 XRD patterns of a) fresh LiNH_2 and LiH after agate ball milling and b) desorbed LiNH_2 and LiH at 200°C . 25
- 4.5 XRD patterns of a) as-received LiNH_2 and b) fresh LiNH_2 after agate ball milling for 2 h. 26
- 4.6 XRD patterns of as-received LiH . 27
- 4.7 XRD patterns of a) as-received LiAlH_4 , b) fresh LiAlH_4 after milling, and c) desorbed LiAlH_4 at 200°C . 28
- 4.8 Temperature program desorption from room temperature to 200°C with the heating rate of 2°C min^{-1} by using agate ball milling for 1 h: a) pure LiAlH_4 b) 1:5 mol ratio of LiNH_2 and LiAlH_4 c) 1:3 mol ratio of LiNH_2 and LiAlH_4 d) 1:1 mol ratio of LiNH_2 and LiAlH_4 , and e) pure LiNH_2 . 29
- 4.9 XRD patterns of 1:5 mol ratio of LiNH_2 and LiAlH_4 : a) fresh after ball milling and b) desorbed at 200°C . 30
- 4.10 Temperature program desorption of 1:5 mol ratio of LiNH_2 and LiAlH_4 mixed by using agate ball milling for 1 h: a) doped with 4 mol% ZrCl_4 , b) doped with 4 mol% TiO_2 , and c) undoped. 31
- 4.11 XRD patterns of 4 mol% TiO_2 -1:5 mol ratio of LiNH_2 and LiAlH_4 : a) fresh after ball milling and b) desorbed at 200°C . 32
- 4.12 XRD patterns of 4 mol% ZrCl_4 -1:5 mol ratio of LiNH_2 and LiAlH_4 : a) fresh after ball milling, b) desorbed at 200°C , and c) absorbed at 180°C . 32
- 4.13 Temperature program desorption of 1:5 mol ratio of LiNH_2 and LiAlH_4 mixed by using agate ball milling for 1 h: a) doped with 4 mol% ZrCl_4 , b) doped with 1 mol% ZrCl_4 , and c) undoped. 33
- 4.14 Temperature program desorption from the mixture of LiNH_2 and LiAlH_4 with 1:1 mol ratio by using agate ball milling for 1 h: a) first cycle and b) subsequent cycles. 34

- 4.15 XRD patterns of 1 mol% ZrCl₄-1:5 mol ratio of LiNH₂ and LiAlH₄: a) fresh after ball milling, b) desorbed at 200°C, and c) absorbed at 180°C. 35
- 4.16 Packing configuration of LiNH₂ and LiAlH₄ mixtures: a) two-layered sample both of which doped with 4 mol% ZrCl₄, b) two-layered sample and only LiAlH₄ doped with 4 mol% ZrCl₄, and c) both hydrides mixed with 4 mol% ZrCl₄. 36
- 4.17 Correlation between temperature and hydrogen capacity, during hydrogen desorption on a 1:5 mol ratio of LiNH₂ and LiAlH₄: a) two-layered sample each of which doped with 4 mol% ZrCl₄, b) two-layered sample only LiAlH₄ doped with 4 mol% ZrCl₄, and c) one-layered sample doped with 4 mol% ZrCl₄. 37
- 4.18 Correlation between temperature and hydrogen capacity, during hydrogen desorption on a 1:1 mol ratio of LiNH₂ and LiAlH₄: a) two-layered sample which are doped with 4 mol% VCl₃, b) two-layered sample which are doped with 4 mol% ZrCl₄, and c) undoped. 38
- 4.19 XRD patterns of 4 mol% ZrCl₄-LiNH₂: a) fresh after ball milling and b) desorbed at 200°C. 39
- 4.20 XRD patterns of 4 mol% ZrCl₄-LiAlH₄: a) fresh after ball milling and b) desorbed at 200°C. 39
- 4.21 TPD-MS patterns of ammonia (m/z = 17) from LiNH₂: a) undoped and b) doped with 4 mol% ZrCl₄. 41
- 4.22 TPD-MS patterns of hydrogen (m/z = 2) from LiNH₂: a) undoped and b) doped with 4 mol% ZrCl₄. 41
- 4.23 TPD-MS patterns of ammonia (m/z = 17) from: a) pure LiNH₂ and b) 1:1 mol ratio of LiNH₂ and LiAlH₄. 42
- 4.24 TPD-MS patterns of ammonia (m/z = 17) from the mixture of LiNH₂ and LiAlH₄: a) 1:5 mol ratio and b) 1:1 mol ratio. 42

- 4.25 TPD-MS patterns from a 1:1 mol ratio of LiNH_2 and LiAlH_4 : a) ammonia and b) hydrogen. 43
- 4.26 TPD-MS patterns from a 1:5 mol ratio of LiNH_2 and LiAlH_4 : a) hydrogen and b) ammonia. 44
- 4.27 TPD-MS patterns of ammonia ($m/z = 17$) from a 1:5 mol ratio of LiNH_2 and LiAlH_4 by using agate ball milling for 1 h: a) undoped and b) doped with 4 mol% ZrCl_4 . 45
- 4.28 TPD-MS patterns from a 1:5 mol ratio of LiNH_2 and LiAlH_4 doped with 4 mol% ZrCl_4 by using agate ball milling for 1 h: a) hydrogen and b) ammonia. 45
- 4.29 TPD-MS patterns of hydrogen ($m/z = 2$) from a 1:5 mol ratio of LiNH_2 and LiAlH_4 doped with 4 mol% ZrCl_4 : a) two-layered sample each of which doped with 4 mol% ZrCl_4 and b) one-layered sample. 46