PROCESSING OF IRON NUGGET FROM LOW GRADE IRON ORE

Leasak Cheawchanpattanagone

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Thesis Title:	Processing of Iron nugget from low grade Iron ore
By:	Leasak Cheawchanpattanagone
Program:	Petroleum Technology
Thesis Advisor:	Prof. Anuvat Sirivat
Co-advisor:	Asst. Prof. Kitipat Siemanond

Accepted by The Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

..... College Dean
(Asst. Prof. Pomthong Malakul)

Thesis Committee:

.....
(Prof. Anuvat Sirivat)

.....
(Asst. Prof. Kitipat Siemanond)

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

.....
(Dr. Sumonman Niamlang)

บทคัดย่อ

นายเลอศักดิ์ เชี่ยวชาญพัฒนากร : กระบวนการผลิตเหล็กก้อนจากแร่เหล็กคุณภาพต่ำ (Processing of Iron Nugget from Low Grade Iron Ore) อ. ที่ปรึกษาหลัก: ศ.ดร. อนุวัฒน์ ศิริวัฒน์ และ ผศ. ดร. กิติพัฒน์ สีมานนท์ 239 หน้า

แร่เหล็กเป็นวัตถุดิบหลักในการผลิตเหล็กในปัจจุบันการที่แร่เหล็กคุณภาพมีแนวโน้มที่จะมีราคาสูงและหายากมากขึ้นจึงทำให้มีการพัฒนากระบวนการผลิตเหล็กที่สามารถใช้แร่เหล็กคุณภาต่ำมาทดแทนในการผลิต หนึ่งในกระบวนการที่ถูกพัฒนาขึ้นโดย Kobe Steel, Ltd และ Midrex Technologies คือ "Iron Making Technology Mark three" (ITmk3) สามารถใช้แร่เหล็กคุณภาพต่ำและยังมีความยืดหยุ่นในการใช้ตัวรีดิวซ์ได้หลากหลายในการผลิต"Iron Nugget" คุณภาพเหล็กสูง ดังนั้นจุดประสงค์ในงานวิจัยนี้เพื่อศึกษากระบวนการ ITmk3 และตัวแปรที่มีผลในการผลิต Iron Nugget ตัวแปรที่ศึกษาคือ สัดส่วนของวัตถุดิบที่ใช้ อุณหภูมิรีดักชั่น และเวลารีดักชั่น เพื่อหาสภาวะที่เหมาะสมที่สุดในการผลิต Iron Nugget จากแร่เหล็กที่มีเหล็ก 50 – 60 % และถ่านหินคุณภาพต่ำเป็นวัตถุดิบ จากการศึกษาสภาวะที่ดีที่สุดซึ่งสามารถผลิต Iron Nugget ที่มีเหล็กมากกว่า 94 % โดยมี % ผลผลิตมากกว่า 90 % จากการใช้อัตราส่วนโมลของวัตถุดิบดังนี้ C/Fe = 1.53, Limestone/Al_2O_3+SiO_2 = 0.75, Bentonite/Fe = 0.02 และถูกรีดิวซ์ที่อุณหภูมิ 1425 องศาเซลเซียสเป็นเวลา 20 นาที

ABSTRACT

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Nowadays, the sources of high grade materials are rare and limited. A new technology which can produce iron nuggets from low grade materials is known as "Iron making Technology Mark Three" (ITmk3). Our objective is to study the ITmk3 process to produce iron nuggets and the parameters that control the quality of the iron nuggets, such as the weight ratios of feeds, the reduction time, and the reduction temperature. The ultimate goal of this work is to determine the suitable conditions to produce iron nuggets from low grade iron ore which has 40-60% iron content and a low grade coal as the raw materials. The suitable conditions for making Iron nugget (over 94 %Fe and % yield more than 94 %), from a pellet which has a diameter of 2.5 cm and 4 cm high, are by using the mol ratios of the mixture as C/Fe = 1.53, Limestone/Al_2O_3+SiO_2 = 0.75, and Bentonite/Fe = 0.02/1with the reduction temperature of 1425°C and at the reduction time of 20 min.

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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		xi
CHAPTER		
I	**INTRODUCTION**	1
II	**LITERATURE REVIEW**	3
	2.1 Iron Ore	3
	2.1.1 Types of Iron Ore	3
	2.1.2 Grades of Iron Ore	3
	2.2 ITmk3 Technology	4
	2.2.1 Reactions in ITmk3 Process	5
	2.2.2 ITmk3 Process Flowsheet	5
	2.2.3 Product Features	7
	2.3 Direct Reduction	7
	2.4 Binder	9
	2.5 Iron Nugget Production by ITmk3	11
III	**EXPERIMENTAL**	15
	3.1 Raw Material	15
	3.1.1 Iron Ore	15

CHAPTER **PAGE**

3.1.2 Reductant 16
3.1.3 Flux 16
3.1.4 Binder 16
3.2 Equipments 17
3.3 Characterizations 17
3.3.1 Energy Dispersive X-Ray Fluorescence (EDXRF) 17
3.3.2 X-Ray Diffraction (XRD) 17
3.3.3 Scanning Electron Microscope (SEM) 18
3.3.4 Wet Chemical Analysis 18
3.3.5 Proximate Analysis 18
3.3.6 Microstructure Analysis 18
3.3.7 Density of Iron Nugget 18
3.4 Methodology 18
3.4.1 Grinding Raw Materials 18
3.4.2 Mixing and the Pellet Preparation 19
3.4.2.1 Amounts of the Raw Materials in Mixtures of Experiments 1–7 19
3.4.2.2 Pellet Preparation 21
3.4.3 Reduction 22
3.4.3.1 Experiments 1 and 2 22
3.4.3.2 Experiments 3–7 23

IV PROCESSING OF IRON NUGGET FROM LOW GRADE IRON ORE 28
Abstact 28
Introduction 29
Experimental 30
Results 33
Discussion 43
Conclusions 44

CHAPTER		PAGE
	References	44
V	**CONCLUSIONS**	46
	REFERENCES	47
	APPENDICES	50
	Appendix A Raw Materials	50
	Appendix B Calculation of Pellet Mixtures	58
	Appendix C Sample Preparation	61
	Appendix D Result	72
	Appendix E Raw Data	108
	Appendix F Experiment 7	235
	CURRICULUM VITAE	239

LIST OF TABLES

TABLE		PAGE
	CHAPTER III	
3.1	Wt % Element of XK-01	15
3.2	Proximate Analysis of the Dai coal	16
3.3	Amounts of the raw materials in the mixtures of experiments 1–7	20
3.4	The reduction condition of experiment 1	24
3.5	The reduction condition of experiment 2	24
3.6	The reduction condition of experiment 3	25
3.7	The reduction condition of experiment 4	26
3.8	Experiment 5; varied mol ratio C/Fe which using suitable condition from experiment 4	26
3.9	Experiment 6; varied mol ratio Mol ratio Limestone/Al_2O_3+SiO_2 which using suitable condition from experiment 4–5	27
3.10	The reduction condition of experiment 7 which using suitable condition from experiment 4–6	27
	CHAPTER IV	
1	The mol ratios and the weights of the raw materials in the mixtures	32
2	Composition of the XK-01 iron ore by the Wet Chemical Analysis from the Rock and Mineral Analysis Department of Mineral Resources, Thailand	33
3	Wt % Element of XK-01 by Energy Dispersive X-Ray Fluorescence (Horiba, model 51-ADD0014)	34
4	Proximate Analysis of the Dai coal	35
5	Composition of CP limestone	35

TABLE **PAGE**

6	Composition of Sodium Bentonite From Volclay Siam Ltd.	36
7	Particle Size of raw materials	36
8	The weight of No. 1.1–1.19 after reduction time 50 min, % Fe Nugget from EDX and % Yield	37
9	The weight of No. 2.1–3.9 after reduction (1425°C and 20 min), % Fe Nugget from EDX and % Yield	38
10	Wt % Element of sample No.3.4	41

LIST OF FIGURES

FIGURE		PAGE
	CHAPTER II	
2.1	Fe-C Phase Diagrem.	4
2.2	ITmk3 process flowsheet.	6
2.3	The corresponding experimental furnace temperatures and residence times.	13
	CHAPTER III	
3.1	Grinding steps.	18
3.2	Step of pellet preparation.	20
3.3	Cylindrical molds A and B.	21
3.4	Temperature profile of furnace, experiments 1 and 2.	22
3.5	Temperature profile of furnace, experiments 3–7.	23
	CHAPTER IV	
1	Grinding steps.	30
2	Step of pellet preparation.	31
3	Mold and sizes of the pellets	38
4	% Fe vs. reduction temperature between samples No.1.1 and No. 1.7.	39
5	% Element of Iron nugget vs. Mol ratio C/Fe between samples No.2.1 to No. 2.8.	39
6	% Element of Iron nugget vs. Mol ratio of Limestone/Al_2O_3+SiO_2 between samples No. 3.2 to No. 3.9.	40
7	The nugget and slag from 3 pellet of sample No. 3.4 after the reduction.	41

FIGURE **PAGE**

8	The backscattered SEM image of cross section iron nugget No. 3.4	42
9	Type of separation	43