

ผลของสารโคปและกระบวนการทางความร้อนต่อสัณฐานวิทยาและสมบัติทางแม่เหล็ก  
ของแบเรียมเฮกซาเฟอร์ไรต์ชนิดเอ็มที่เตรียมด้วยวิธีตกตะกอนร่วม



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ศูนย์วิทยทรัพยากร  
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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต

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EFFECTS OF DOPING MATERIALS AND HEAT TREATMENT ON  
THE MORPHOLOGY AND MAGNETIC PROPERTIES OF  
M-TYPE BARIUM HEXAFERRITE PRODUCED BY CO-PRECIPITATION



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By                                    Miss Siriphan Nilpairach

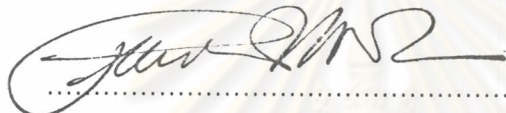
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สิริพรรณ นิลไพรัช : ผลของสารโดปและกระบวนการทางความร้อนต่อลักษณะทางวิทยาและสมบัติทางแม่เหล็กของแบเรียมเฮกซาเฟอร์ไรต์ชนิดเอ็มที่เตรียมด้วยวิธีตกตะกอนร่วม (EFFECTS OF DOPING MATERIALS AND HEAT TREATMENT ON THE MORPHOLOGY AND MAGNETIC PROPERTIES OF M-TYPE BARIUM HEXAFERRITE PRODUCED BY CO-PRECIPTATION) อ. ที่ปรึกษา : รศ. ดร. วีระศักดิ์ อุดมกิจเดชา, อ. ที่ปรึกษาร่วม : ศ. ดร. อิมิ่ง ถัง. 102 หน้า. ISBN 974-17-4914-7

อนุภาคแบเรียมเฟอร์ไรต์ชนิดโดปและชนิดที่ไม่มีสารโดปโคบอลต์-ดีบุก ( $\text{BaFe}_{12-2x}\text{Sn}_x\text{Co}_x\text{O}_{19}$  โดย X มีค่า 0.00, 0.25, 0.50, 0.75 และ 1.00) เตรียมโดยวิธีการตกตะกอนร่วม โดยใช้อัตราส่วนโมลของเหล็กต่อแบเรียม ระหว่าง 8.1 ถึง 10.1 แล้วนำผงที่ได้มาเผาแคลไซต์ที่อุณหภูมิ ระหว่าง 950 ถึง 1200 องศาเซลเซียส โดยใช้อุณหภูมิห่างกันช่วงละ 50 องศาเซลเซียส เป็นเวลานาน 4 ชั่วโมง ตรวจสอบองค์ประกอบทางเคมีด้วยเครื่องเอ็นเนอร์จีดีสเพอร์ซีฟเอกซ์เรย์ (Energy dispersive X-ray) พบว่าตัวอย่างที่ไม่มีสารโดปองค์ประกอบเป็น ไอรอนริช (Fe-rich) ในขณะที่ตัวอย่างที่มีสารโดปองค์ประกอบเป็นแบเรียมริช (Ba-rich) ทำการตรวจวัดขนาดอนุภาคจากทรานสมิชชันและสแกนนิ่งอิเล็กตรอนไมโครกราฟ (Transmission and scanning electron micrographs) และตรวจสอบสมบัติทางแม่เหล็กด้วยเครื่องไวเบรติงแซมเปิลแมกนีโตมิเตอร์ (Vibrating sample magnetometer) พบว่าค่าสนามการทำลายล้างความเป็นแม่เหล็ก (Coercivity) ลดลงเมื่อมีการโดปเพิ่มขึ้น และสังเกตพบความสัมพันธ์ระหว่างค่าสนามการทำลายล้างความเป็นแม่เหล็กกับอัตราส่วนระหว่างพื้นที่ผิวและปริมาตรของอนุภาค เมื่อทำการตรวจวัดสนามแม่เหล็กภายในโดยวิธีมอสบาวเออร์สเปกโตรสโคปี (Mossbauer spectroscopy (MS)). พบว่าสเปกตรัมแสดงว่าโครงสร้างของตัวอย่างที่โดปมีความมีความเป็นระเบียบมากขึ้นเมื่อระดับของการโดปเพิ่มขึ้น อุณหภูมิที่เหมาะสมสำหรับการเตรียมแบเรียมเฟอร์ไรต์ (BaF) เพื่อใช้เป็นสารบันทึกแบบแม่เหล็ก คือ 1000 องศาเซลเซียส และระดับ (nominal level) ของสารโดปมีค่า 0.25 - 0.50 เนื่องจากสามารถให้สมบัติแม่เหล็กที่ต้องการ

ภาควิชา.....วัสดุศาสตร์.....ลายมือชื่ออนิสิต.....  
 สาขาวิชา.....วัสดุศาสตร์.....ลายมือชื่ออาจารย์ที่ปรึกษา.....  
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KEY WORD : BARIUM HEXAFERRITE, CO-PRECIPITATION, MAGNETIC PROPERTIES,  
DOPING MATERIALS

SIRIPHAN NILPAIRACH : EFFECT OF DOPING MATERIALS AND HEAT  
TREATMENT ON THE MORPHOLOGY AND MAGNETIC PROPERTIES OF  
M-TYPE BARIUM HEXAFERRITE PRODUCED BY CO-PRECIPITATION. THESIS  
ADVISOR: ASSOC. PROF. WERASAK UDOMKICHDECHA, Ph.D. THESIS  
CO-ADVISOR: PROF. I MING TANG, Ph.D. 102 pp. ISBN 974-17-4914-7

Undoped and Co-Sn substituted barium ferrite  $\text{BaFe}_{12-2x}\text{Sn}_x\text{Co}_x\text{O}_{19}$  particle with nominal composition  $x= 0.00, 0.25, 0.50, 0.75$  and  $1.00$  had been synthesized by the co-precipitation method. Mole ratios of Fe/Ba in the range of  $8.1-10.1$  were used. Powders of the mixtures were then calcinated for 4 hours at  $50^\circ\text{C}$  intervals between  $950^\circ\text{C}$  and  $1200^\circ\text{C}$ . The chemical compositions were determined by energy dispersive X-ray spectrometer. It was found that the undoped samples were Fe-rich, while the doped samples were Ba-rich. The particle sizes were determined from the transmission and scanning electron micrographs. The magnetic properties were measured with a vibrating sample magnetometer. It was found that coercivity decreased as the doping increased. It was observed that there was a correlation between the coercivity and the surface area to volume ratio of the grains. The internal magnetic fields were determined by Mossbauer spectroscopy (MS). The MS spectrums showed that the magnetic structure of the doped samples became more ordered as the doping level increased. The optimum temperature for the preparation of BaF for use in magnetic recording was found to be  $1000^\circ\text{C}$  with nominal dopant levels between  $0.25-0.50$  since the optimal magnetic properties needed were obtained.

Department..... Materials Science ..... Student's signature *Siriphan Nilpairach*  
Field of study... Materials Science ..... Advisor's signature *Werak Udomkichdecha*  
Academic year... 2003 ..... Co-advisor's signature *I. Ming Tang*

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