

ห้องสมุดงานวิจัย สำนักงานคณะกรรมการวิจัยแห่งชาติ



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CHARACTERIZATION OF LANTHANUM AND CERIUM
PHOSPHATE NANOSTRUCTURES SYNTHESIZED
BY MICROWAVE RADIATION METHOD

NUENGRUETHAI EKTHAMMATHAT

MASTER OF SCIENCE
IN CHEMISTRY

THE GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
MARCH 2011

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**A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN
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FOR THE DEGREE OF
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THIS THESIS HAS BEEN APPROVED
TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS
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IN CHEMISTRY

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4 March 2011

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Thesis Title	Characterization of Lanthanum and Cerium Phosphate Nanostructures Synthesized by Microwave Radiation Method
Author	Miss. Nuengruethai Ekthammathat
Degree	Master of Science (Chemistry)
Thesis Advisor	Assoc. Prof. Titipun Thongtem

Abstract

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Until now scientists and engineers have been focused on the researches of the lanthanide metal phosphate compounds such as LaPO_4 , CePO_4 , NdPO_4 , EuPO_4 and TbPO_4 , due to their wide use as phosphors, photonic and gas sensors and heat-resistant materials. In this research, LaPO_4 and CePO_4 nanostructures were successfully synthesized from $\text{LaCl}_3 \cdot 7\text{H}_2\text{O}$, $\text{Ce}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ and $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$ with the pH adjusting at 1 - 6 using 37 % HNO_3 , by the microwave radiation at 180 W for 60 min. XRD patterns indicated that the as-synthesized products are pure phase of LaPO_4 and CePO_4 nanostructures. Using SEM and TEM, these products were nanoparticles, short nanorods and long nanorods, controlled by the pH of the precursor solutions. Optical properties of the product were investigated by UV-visible

(UV-vis) and photoluminescence (PL) spectroscopy, and the results were in accordance with the previous reports.

ชื่อเรื่องวิทยานิพนธ์	การหาลักษณะเฉพาะของโครงสร้างนาโนแลนทานัมและซีเรียมฟอสเฟตที่สังเคราะห์โดยวิธีรังสีไมโครเวฟ
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บทคัดย่อ

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ตราบจนกระทั่งปัจจุบันนี้ นักวิทยาศาสตร์และวิศวกรได้มุ่งเน้นศึกษาเกี่ยวกับสารประกอบโลหะแลนทานาในค้ฟอสเฟตโครงสร้างนาโน เช่น แลนทานัมฟอสเฟต ซีเรียมฟอสเฟต ไนโอดีเนียมฟอสเฟต ยูโรเพียมฟอสเฟต และเทอร์เบียมฟอสเฟต เนื่องจากเป็นสารประกอบโลหะแลนทานาในค้ฟอสเฟตที่สามารถนำไปใช้อย่างแพร่หลายในกลุ่มสารเรืองแสง ตัวตรวจจับแสง แก๊ส และวัสดุทนความร้อน ในงานวิจัยนี้ได้สังเคราะห์แลนทานัมฟอสเฟตและซีเรียมฟอสเฟตโครงสร้างนาโนขึ้นจากการเกิดปฏิกิริยาของแลนทานัมไตรคลอไรด์เฮปตะไฮเดรต ซีเรียมไนเตรดเฮกซะไฮเดรต และไตรโซเดียมฟอสเฟต โดยการปรับค่าพีเอชที่ 1-6 ด้วยกรดไนตริกเข้มข้น 37% โดยใช้รังสีไมโครเวฟ 180 วัตต์ เป็นเวลา 60 นาที ผลการวิเคราะห์ด้วยเทคนิคการเลี้ยวเบนรังสีเอกซ์ พบว่าผลิตภัณฑ์ที่สังเคราะห์ได้เป็น แลนทานัมฟอสเฟตและซีเรียมฟอสเฟตโครงสร้างนาโนเฟสบริสุทธิ์เมื่อวิเคราะห์ด้วยเทคนิคกล้องจุลทรรศน์แบบส่องกราดและกล้องจุลทรรศน์แบบส่องผ่าน พบว่าผลิตภัณฑ์ประกอบด้วยอนุภาคนาโน แท่งนาโนแบบสั้นและยาว ที่ควบคุมโดยค่าพีเอชของ

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ABBREVIATIONS AND SYMBOLS

°C	=	Degree Celsius
nm	=	Nanometer
μm	=	Micrometer
ml	=	Milliliter
min	=	Minute
sec	=	Second
λ	=	Wavelength
cm	=	Centimeters
W	=	Watt
α	=	Alpha
β	=	Beta
γ	=	Gamma
Å	=	Angstrom
h	=	Hour
La	=	Lanthanum
Ce	=	Cerium
FTIR	=	Fourier Transform Infrared Spectroscopy
PL	=	Photoluminescence
SEM	=	Scanning Electron Microscopy

TEM	=	Transmission Electron Microscopy
XRD	=	X-ray Diffraction
JCPDS	=	The Joint Committee on Powder Diffraction Standards