SYNTHESIS AND CHARACTERIZATION OF Eu^{3+} DOPED YTTRIA-STABILIZED ZIRCONIUM OXIDE NANOCRYSTALS BY CHEMICAL METHOD

RUNGSIT LUNDA

A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Master of Science Degree in Chemistry
October 2011

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This thesis entitled "Synthesis and Characterization of Eu^{3+} doped Yttria-Stabilized Zirconium Oxide Nanocrystals by Chemical Method" submitted by Rungsit Lunda in partial fulfillment of the requirements for the Master of Science Degree in Chemistry is hereby approved.

..... Chair
(Assistant Professor Chompoonuch Puchmark, Ph.D.)

..... Committee
(Assistant Professor Lt. Jg. Nipaphat Charoenthai, Ph.D.)

..... Committee
(Assistant Professor Rakchart Traiphol, Ph.D.)

..... Committee
(Assistant Professor Theerachai Bongkarn, Ph.D.)

..... Committee
(Assistant Professor Somsak Dangtip, Ph.D.)

Approved

.....
(Assistant Professor Kanungnit Pupatwibul, Ph.D.)
Dean of the Graduate School
11 October 2011

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Rungsit Lunda

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Advisor	Assistant Professor Lt. Jg. Nipaphat Charoenthai, Ph.D.
Co - Advisor	Assistant Professor Rakchart Traiphol, Ph.D.
	Assistant Professor Theerachai Bongkarn, Ph.D.
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ABSTRACT

In this research, ZrO_2 crystals co-doped with Y and Eu were prepared by wet chemical method. The mole ratios of Y and Eu were varied while the mole ratio of Zr was kept constant. The ZrO_2: Y: Eu crystals were obtained by calcination at 800 °C for 1 h. From XRD, FT-IR spectra, it was found that the monoclinic phase of pure ZrO_2 crystals transformed to tetragonal and cubic phase upon introducing Y and Eu into the crystals. The effect of phase transformation on optical property of ZrO_2 doped with Y and Eu was investigated by photoluminescence (PL) under UV excitation at 260 nm. The PL spectra of samples exhibited a red luminescent emission of Eu. The ZrO_2: 4%Y: 3%Eu crystals provided the highest luminescence efficiency with the cubic structure. The PL intensity varied with the calcinations temperature, ranging from 600 to 1000 °C. The calcination temperature at 800 °C yielded highest PL intensity. The variation of chelating agents used during the preparation process does not affect the crystal structure of ZrO_2: 3%Eu: 4%Y. The emission intensity, however, varied with type of chelating agents. These phosphor materials were embedded in various polymeric films. PL spectra of composite films of ZrO_2: 4%Y: 3%Eu embedded in different polymers exhibited strong red regions. The emission intensity of composite films depended on the polarity of the polymer.

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ABBREVIATIONS

CRT	=	cathode ray tube
LEDs	=	light emitting diodes
PDP	=	plasma display panel
EL	=	electroluminescence
ACTFEL	=	alternating current thin film electroluminescent
FED	=	field Emission Display
UV/VIS	=	ultraviolet and Visible
RE^{3+}	=	rare earth ions
Eu^{3+}	=	europium ion
Tb^{3+}	=	terbium ion
Dy^{3+}	=	dysprosium ion
Er^{3+}	=	erbium ion
Pr^{3+}	=	presidium ion
Sm^{3+}	=	samarium ion
TM	=	transition metal
Mn	=	manganese
Ni	=	nikel
eV	=	electron volts
A.R.	=	analytical reagent
M	=	molar
pH	=	power of hydrogen ion concentration
EDTA	=	ethylenediaminetetraacetic acid
PVA	=	polyvinylalcohol
PS	=	polystyrene
PMMA	=	polymethylmethacrylate
PAA	=	polyacrylic acid
DI	=	deionized
mg	=	milligram

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ABBREVIATIONS (CONT.)

XRD	=	x-ray diffraction
FT-IR	=	fourier transform infrared spectroscopy
SEM	=	scanning electron microscopy
PL	=	photoluminescence
JCPDS	=	joint committee on powder diffraction standards
(h k l)	=	miller indices
λ	=	wavelength (lamda)
kW	=	kilowatts