THERMOGRAVIMETRIC AND X-RAY DIFFRACTION ANALYSES ON CERATE-ZIRCONATE POWDER PREPARED VIA DIFFERENT CHELATING AGENTS

NUR AINUL SYAIZRAH AZMAN

BACHELOR OF SCIENCE (Hons.) PHYSICS
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

AUGUST 2022

THERMOGRAVIMETRIC AND X-RAY DIFFRACTION ANALYSES ON CERATE-ZIRCONATE POWDER PREPARED VIA DIFFERENT CHELATING AGENTS

NUR AINUL SYAIZRAH AZMAN

Final Year Project Report Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Physics
in the Faculty of Applied Sciences
Universiti Teknologi MARA

AUGUST 2022

This Final Year Project Report entitled **"Thermogravimetric and X-Ray Diffraction Analyses on Cerate-Zirconate Powder Prepared via Different Chelating Agents"** was submitted by Nur Ainul Syaizrah Binti Azman in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Physics, in the Faculty of Applied Sciences, and was approved by

_____

Prof. Madya Dr. Nafisah Mohd Isa @ Osman
Supervisor
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

_____

Dr. Khuzaimah Nazir
Project Coordinator
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

_____

Prof. Madya Dr. Ramani Mayappan
Internal Examiner
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Date: _____

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Under Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of student	: Nur Ainul Syaizrah Binti Azman
Student I.D. no.	: 2019685868
Programme	: Bachelor of Science (Honours) Physics (AS203)
Faculty	: Faculty of Applied Sciences
Thesis title	: Thermogravimetric and X-ray Diffraction Analyses on Cerate-Zirconate Powder Prepared via Different Chelating Agents
Signature of student	: ……..
Date	: August 2022

ABSTRACT

Developing SOFCs with a proton-conducting ceramic oxide as the electrolyte, also known as proton ceramic fuel cells (PCFCs), is widely investigated. Ceramic powder based on cerate-zirconates has a wide range of applications, including use as a solid electrolyte in SOFCs. Wet chemical methods (WCMs), such as the sol-gel technique, are commonly used in research laboratories because they can produce high purity powders at relatively low temperatures. The powder of $BaCe_{0.54}Zr_{0.36}Y_{0.1}O_{2.95}$ (BCZY) was synthesised using a sol-gel process aided by chelating agents in this study. Citric acid, triethylenetetramine (TETA), and ethylenediaminetetraacetic acid (EDTA) were used as chelating agents. The result of powder properties was characterised using thermogravimetric analysis (TGA) and an X-Ray diffractometer (XRD). The samples were dried at 325 °C and calcined at various temperatures. TGA was used to study the thermal behaviour of dried samples, and the results revealed that all of the samples almost fully decomposed at 1000 °C. It was discovered that the amount of organic compounds produced during thermal breakdown of samples increased as the molecular weight of chelating agents increased. TGA confirmed that the weight loss of intermediate compounds increased as the chelating agents' molecular weight, M_w, increased as following: A3 (35%) < A1 (93%) < A2 (95%). Except for the sample prepared with TETA, all of the samples required processing at substantially higher temperatures to eliminate the carbonates impurities. The XRD patterns of all samples demonstrated successful production of single-phase BCZY crystals at a calcination temperature of 1100 °C. A3 has the highest percentage of BCZY perovskite phase which is 98.9%. XRD measurements confirm that the sample generated with TETA has a high crystalline of BCZY powders. Hence, TETA was discovered to be the best chelating agent in collaborating with metal nitrate salts to produce a pure phase of BCZY powders.