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Title: Acceptance/ Invitation Letter for Presentation

Dear Mr.Sanit Suwanwong,

On behalf of the organizing committee of URU International Conference on Science and Technology (URUICST2018) which will be held on 2-3 August, 2018 at Uttaradit Rajabhat University, Uttaradit, Thailand. I am pleased to inform you that your manuscript entitled "Structural and Dielectric Properties of Zn2TiO4 Ceramic from Sol-Gel Method" has been accepted for Poster Presentation at URUICST2018.

For more detailed information about the conference and accommodation, please visit the conference website: http://www.uruicst2018.uru.ac.th/

Thank you for your interest in participating in the conference. I am looking forward to meeting you at the conference.

Yours sincerely,

Assist. Prof. Dr. Ruangdet Wongla
President of Uttaradit Rajabhat University
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Structural and Dielectric Properties of Zn_2TiO_4 Ceramic from Sol-Gel Method

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Abstract. ZnO and TiO_2 are wider-gap semiconductors and transparent under visible range can be used in electronic devices. ZnO and TiO_2 can be prepared by sol-gel. And then the pellets was sintered at 800°C. It can occurred cubic-phase in Zn_2TiO_4 and the lattice parameter about 8.4554 Å by XRD pattern and the oxidation state of Zn ions was Zn^{2+} by the X-ray absorption spectroscopy technique. The grains are almost nearly spherical shape by SEM image. In addition, the dielectric spectra, dielectric loss and impedance spectroscopy of Zn_2TiO_4 ceramic decreased as frequency increased from 100 to 10^6 Hz. It can be changed of microstructure and oxygen vacancies due to sintering of the Zn_2TiO_4 ceramic. The results indicated that the Zn_2TiO_4 ceramic could be used as a microelectronic devices.

Introduction

Perovskite materials are wider-gap semiconductors with a variety properties, such as optical, ferroelectric, piezoelectric and good dielectric [1-3]. For zinc oxide (ZnO) and titanium dioxide (TiO_2) are transparent under visible range can be used in electronic devices, dye-sensitized solar cells, laser diodes, light sensor, etc [4-5]. ZnO and TiO_2 can be prepared by the solid-state reaction [6] and the sol-gel [7,8] method and used in a simple preparation, low cost of preparation and spend less time. And then sintered from mixture of ZnO and TiO_2., It can occurred $ZnTiO_3$ and Zn_2TiO_4 phase [9,10].

In this research, Zn_2TiO_4 synthesised by sol-gel method and sintering at 800°C to study structure, dielectric constant and impedance properties of Zn_2TiO_4.

Materials and Methods

Zn_2TiO_4 ceramic was prepared by Sol-Gel and sintering, using materials purity of 99.5% powders of Zinc nitrate hexahydrate (QRec, Inc.) and Titanium (IV) isopropoxide (AJAX, Inc.). The materials were weighted according to the stoichiometric rations 1: 1 and mixed in 50 ml of ethanol and 1 ml of acetic acid for 2 hours with stirred to as sol. And then the sol was annealed at 80°C to as gel. The gel was dried at 200°C for 4 hours as the mixed powder. The mixed powder was calcined at 600°C in air for 5 h. The calcined powder was added about 5wt% PVA binder, and then pressed into cylindrical embryo molds with 15 mm in diameter and 3 mm in thickness under 30 MPa pressure. The pellets was sintered at 800°C in air for 8 h with the heating rate of 5°C/min.

The pellet samples were characterized by X-ray diffraction pattern (XRD, Bruker D-8 Advance) with Cu Kα radiation (λ = 1.5406 Å) to check the phase composition. Information on the oxidation state of Zn ion by XANES technique of X-ray absorption spectroscopy from BL8 beamline at the Synchrotron Light Research Institute (SLRI), Thailand. The SEM image was used to check the grain size and shape of Zn_2TiO_4 and the energy dispersive spectroscopy analysis (EDS) was used to determine ratio of O, Ti and Zn element for weight% and atomic%.

The pellets was polished and coated with Au by sputtering technique on both sides to form electrode. Finally, dielectric and impedance properties were measured from 100 Hz to 1 MHz using the precision impedance analyzer (Agilent 4294A).

Results and Discussion

The XRD pattern sintered at 800°C as for Zn_2TiO_4 shown in Fig.1 that there was a new phase Zn_2TiO_4 occurred at the diffraction peaks of cubic-phase in Zn_2TiO_4 and the lattice parameter about 8.4554 Å. The peaks are identified to (111), (220), (311), (222), (400), (422), (511), (440) and (533) plan reflections of phase Zn_2TiO_4 according to the standard ICSD data file (No. 01-073-0578). The X-ray absorption spectroscopy of Zn_2TiO_4 at around 9,660 eV that the oxidation state of Zn ions was Zn^{2+} shown in Fig.2. The results indicates that the Sol-Gel method in this work could be produced of Zn_2TiO_4 materials.

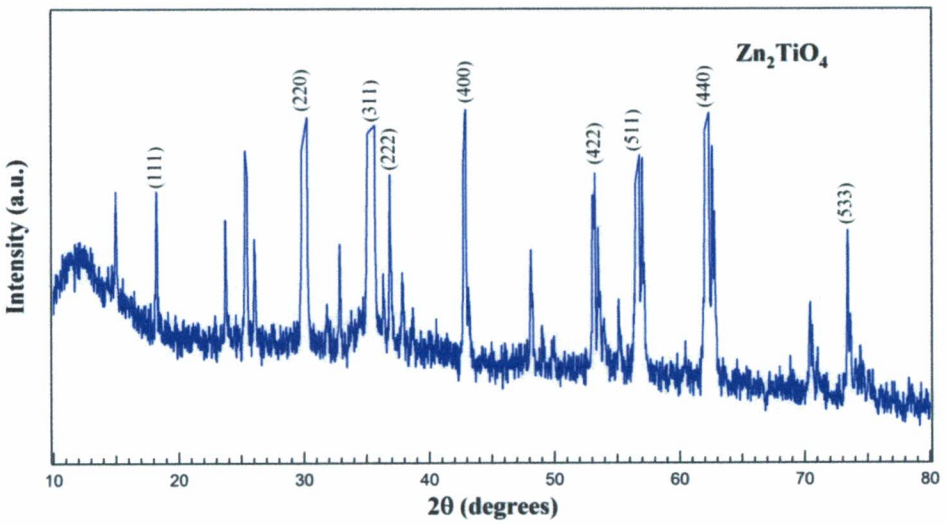

Fig. 1 XRD pattern of Zn_2TiO_4 sintered 800°C.

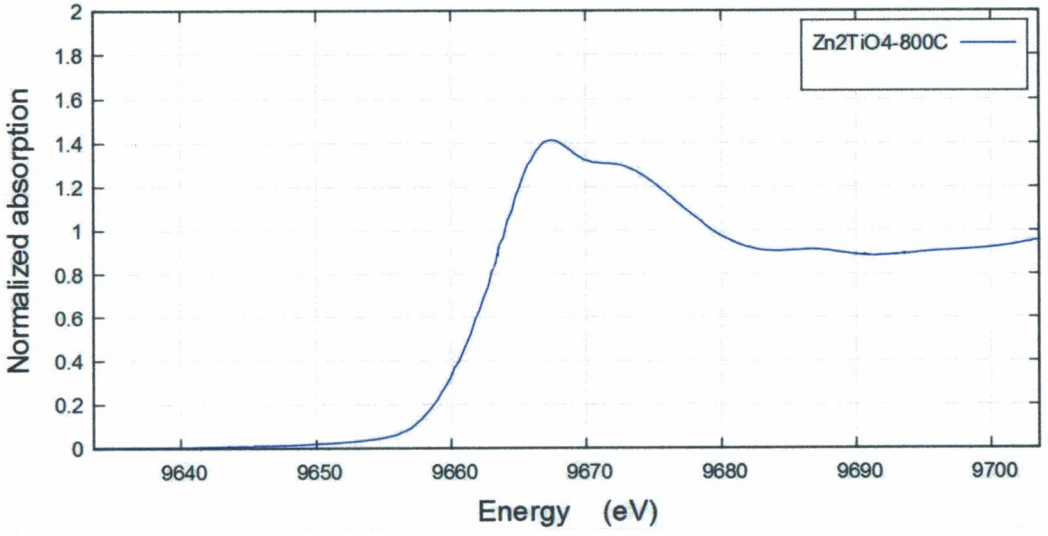

Fig. 2 XAS spectra of Zn_2TiO_4 sintered 800°C.

The SEM image of Zn_2TiO_4 sintered 800°C shown in Fig.3, the grains are almost nearly spherical shape. The average diameter of grain size are about 181 nm to 636 nm and quite porous. In addition study, the energy dispersive spectroscopy analysis (EDS) was used to determine ratio of O, Ti and Zn element for weight% and atomic% shown in table 1.

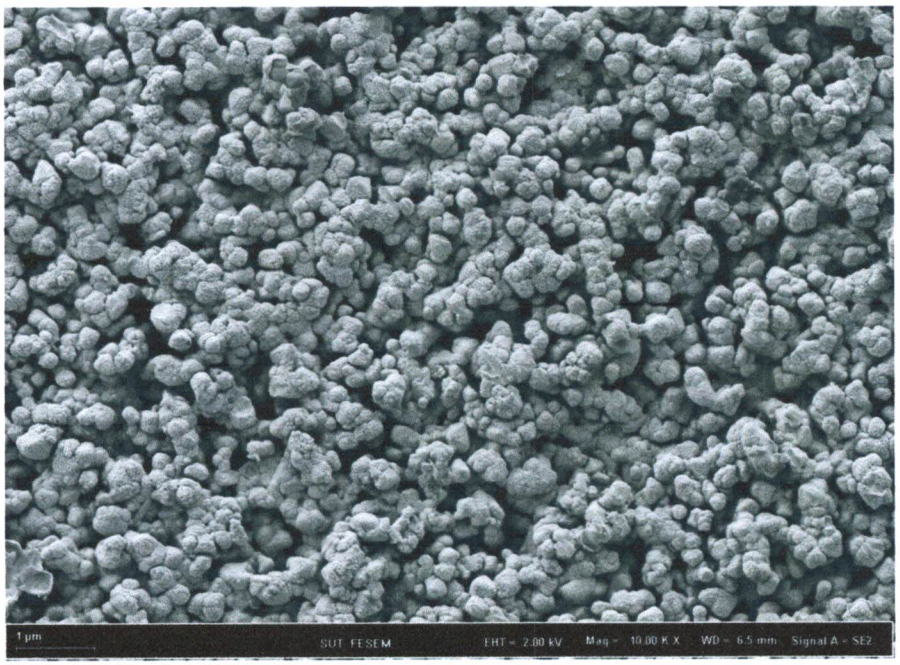

Fig. 3 SEM image of Zn_2TiO_4 sintered 800°C.

Table 1 EDAX analysis of Zn_2TiO_4 ceramic sintered at 800°C.

Element	Weight%	Atomic%
O K	14.62	37.65
Ti K	37.10	31.91
Zn L	48.28	30.44

The dielectric spectra (ε_r) and dielectric loss (tan δ) of Zn_2TiO_4 ceramic sintered at 800°C is shown Fig. 4 (a-b). It can be observed that the dielectric spectra and dielectric loss of Zn_2TiO_4 ceramic decreased as frequency increased from 100 to 10^6 Hz. It can be changed the microstructure and the oxygen vacancies due to sintering of the Zn_2TiO_4 ceramic [4].

The impedance spectroscopy of Zn_2TiO_4 ceramic is shown Fig. 5. It can be seen that the AC impedance decreased as frequency increased due to difference between the grain boundaries and interior in Zn_2TiO_4 ceramic by sintering [9].

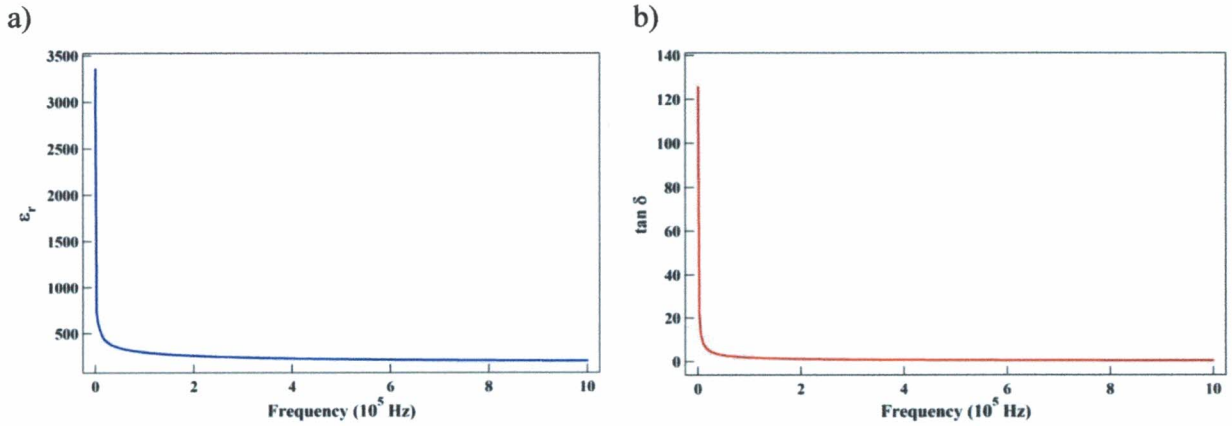

Fig. 4 Frequency dependence of a) dielectric constant and b) dielectric loss for Zn_2TiO_4.

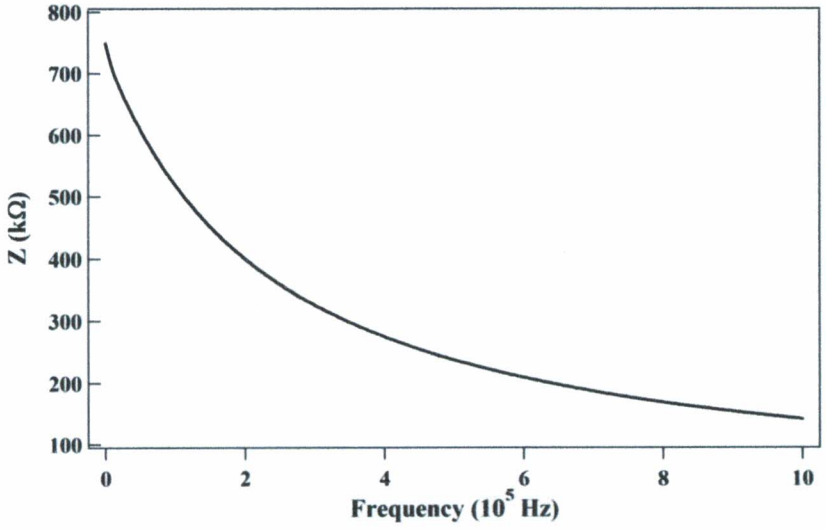

Fig. 5 Frequency dependence of impedance for Zn_2TiO_4.

Summary

The Zn_2TiO_4 ceramic prerared by Sol-Gel and then sintered at 800°C can be occurred at the cubic-phase of Zn_2TiO_4 and the lattice parameter about 8.4554 Å. The X-ray absorption spectroscopy of Zn_2TiO_4 was the oxidation state of Zn ions as Zn^{2+}. The grains are almost nearly spherical shape by SEM image. It can be changed the microstructure and the oxygen. The dielectric constant and dielectric loss of Zn_2TiO_4 ceramic show that decreased quickly as frequency increased. And then the impedance decreased as frequency increased due to difference between the grain boundaries and interior in Zn_2TiO_4 ceramic by sintering. This indicates that the Zn_2TiO_4 ceramic could be used as a microelectronic devices.

Acknowledgments

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CERTIFICATE OF PARTICIPATION

This is to certify that

Sanit Suwanwong

Participated in poster presentation

The International Conference on Science and Technology organized by Faculty of Science and Technology, Uttaradit Rajabhat University held on August 2-3, 2018

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