Ferroelectric and Photovoltaic Properties of $[KNbO_3]_{0.9} - [BaNi_{0.5}Nb_{0.5}O_3]_{0.1}$ Perovskite Ceramics

Saichon Sriphan

Department of Electrical and Computer Engineering, Faculty of Engineering, Naresuan University, Phitsanulok, 65000
Corresponding author. E-mail : saichon_sriphan@hotmail.com

Abstract

Perovskite material, which exhibits ferroelectric (FE) behavior, is widely used for ferroelectric-photovoltaic (FE-PV) cell application. Generally, the bandgap of FE material is very large (E_g > 3 eV), which limits a light absorption to only the ultraviolet region of solar spectrum. Recently, the $(1-x)[KNbO_3]-x[BaNi_{0.5}Nb_{0.5}O_{3-\delta}]$ (KBNNOx) material has been discovered. This material provides very small bandgap ($E_g \sim 1.4$ eV with $x = 0.1$), but, according to the literature, has a low efficiency. Therefore, it needs to be improved in the photo conversion efficiency and demonstrated the effective of KBNNOx-based to design up to the multi-functional devices in a certain property. The objective of the proposed research project is to design a new system of KBNNOx-based ceramic, which provides a good dielectric property and preserves a photovoltaic (PV) response. It has been known that the dielectric property relates to the oxygen vacancy, the $(1-x)[KNbO_3] - x[BaNi_{0.5}Nb_{0.5}O_{3-\delta}]$ with $x = 0.1$ is designed for reducing the effect of oxygen vacancy by setting $\delta = 0$, or called to KBNNO. The details of research are divided into subtopics: synthesis condition, atomic structure investigation, dielectric and PV properties, and effects of thickness and electrode on PV property. The importance of this research is that it will provide essential information to give better understanding of the details of advanced FE-PV materials, and will therefore inform, and provide guidelines for, the further development of high efficiency photo-converter devices, especially but not limited to a new type of PV cell.

Keywords: Solid-State Combustion Technique, X-ray Diffraction Spectroscopy, X-ray Absorption Spectroscopy, Raman Spectroscopy, Dielectric Property, Photovoltaic Property