

# SYNTHESIS AND CHARACTERIZATION OF LEAD-FREE PIEZOELECTRIC (K<sub>0.5</sub>Na<sub>0.5</sub>)NbO<sub>3</sub> PRODUCED WITH IMPROVED CALCINATION TEMPERATURE

Nor Amalina Ahmad<sup>a\*</sup>, Dzetty Soraya Abdul Aziz<sup>a</sup>, Norni Hidayawati Mat Daud<sup>a</sup>, Rahim Noor<sup>b</sup>, Amir Azam Khan<sup>b</sup>

<sup>a</sup>Centre for Pre-University Study, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

<sup>b</sup>Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

## Article history

Received

9 July 2019

Received in revised form

15 January 2020

Accepted

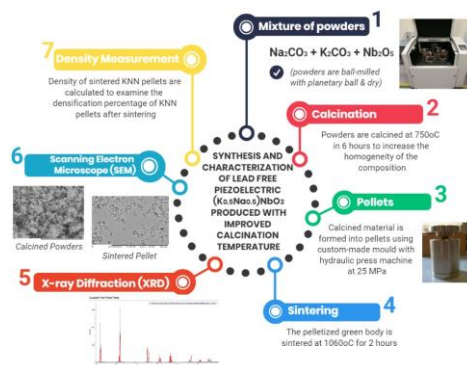
2 February 2020

Published online

27 February 2020

\*Corresponding author  
anamalina@unimas.my

## Graphical abstract



## Abstract

Potassium sodium niobate (KNN) is one of the lead free piezoelectric material that catch the attention of researchers and also those in the industrial field because of its stable piezoelectric responses and environmental friendly composition. The recent development of KNN shows that many methods have been used to synthesize the KNN but the stoichiometric  $Ka_{0.5}Na_{0.5}NbO_3$  composition is extremely difficult to consolidate. One of the ways to overcome the problem is to precisely pre-calcine and use milling process for proper homogenization followed by natural sintering process. In this paper, attempt has been made to synthesize the KNN produced at 750 °C calcination temperature. The results of 1060°C sintering temperature for 2 hours show a good composition of KNN with orthorhombic crystal structure where the final sintered pellet can reach to a relative density up to 87.13 %.

Keywords: Lead-free piezoelectric, KNN, perovskites, sintering, microstructure

## Abstrak

Kalium Natrium Niobat (KNN) merupakan salah satu bahan piezoelektrik bebas plumbum yang mendapat perhatian penyelidik dan bidang industri disebabkan oleh tindak balas piezoelektrik yang stabil dan komposisinya yang mesra alam. Perkembangan KNN terkini menunjukkan pelbagai kaedah dapat dilakukan untuk menghasilkan KNN namun komposisi stoikiometri  $Ka_{0.5}Na_{0.5}NbO_3$  sangat sukar diperolehi. Salah satu kaedah untuk mengatasi masalah ini adalah dengan pra-pemanasan dan menggunakan proses pengisaran bagi mendapatkan homogenisasi yang seimbang diikuti proses persinteran secara semulajadi. Dalam kajian ini, percubaan bagi menghasilkan KNN telah dijalankan pada suhu pemanasan 750 °C. Hasil persinteran pada suhu 1060 °C selama 2 jam menunjukkan komposisi KNN terbaik dengan struktur kristal ortorombik di mana pelet tersebut telah mencapai ketumpatan relatif setinggi 87.13 %.

Kata kunci: Piezoelektrik bebas plumbum, KNN, perovskit, persinteran, mikrostruktur

© 2020 Penerbit UTM Press. All rights reserved