Programme & Proceeding Book

ICXRI 2012

International Conference on X-Rays & Related Techniques in Research & Industry 2012

Vistana Hotel, Penang, Malaysia

3rd - 5th July 2012

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INTRODUCTION
Recently, ferroelectric materials have been intensively studied as candidates for use in a wide range of potential applications [1]. Bismuth Layer-Structured Ferroelectrics (BLSFs) consist of a layer structure of Bi$_2$O$_2$ and a pseudo-perovskite Bi$_2$Ti$_3$O$_{12}$ along the c-axis; which is different from a simple perovskite structure. Bi$_4$Ti$_3$O$_{12}$ is a BLSFs and is known to have a high Curie temperature (675°C), a large remanent polarization ($P_r = 5 - 6.5$ μC/cm$^2$), a low coercive field ($E_c = \sim 50$ kV/cm), and a low processing temperature (750 – 800°C); giving this material a high potential in real applications [2]. Furthermore, BIT is very familiar as a lead-free ceramic material. For the above reason, BIT was investigated by several other researchers. BIT is usually prepared in many ways. Among them, soft combustion has been chosen and employed in this study, due to its simple, more economical and rapid preparation process. Hence, an attempt has been made to investigate the possibility of firing pure BIT at low temperature assisted by other possible parameter studies. Besides that, the characterization on other properties i.e. thermal behaviour, particle morphology, density and electrical properties were also included.

EXPERIMENTAL PROCEDURE
Aqueous solution of Bi$^{3+}$, Ti$^{4+}$ and citric acid were constantly stirred for 24 hour at 60°C. The prepared solution was also added with NH$_4$OH (29% solution) to obtain pH 7. The temperature was raised to 80°C for a dehydration process, prior to the combustion process. The combustion reaction lasted for
less than 5 minutes and produced a dry yellowish powder. The as-burnt powders were uniaxially pressed and sintered at different temperatures. The characterization on the as-burnt powders and sintered samples were carried out, i.e. XRD, Raman, TG-DTA, HRTEM, SEM, and several electrical measurements.

RESULTS AND DISCUSSION
In order to determine the important factor in combustion route, the XRD patterns of as-burnt powder prepared with and without NH$_4$OH were analyzed. The result was obviously different whereby better degree of crystallinity was observed from the sample with NH$_4$OH addition. This implies that the combustion reaction is more beneficial in formation of pure phase BIT at low temperature assisted by extra fuel agent. Thus, NH$_4$OH has plays double functions i.e. fuel agent and chelating agent. Based on TG-DTA curve, the decomposition temperature was approximately around 500°C, which might be considered as combustion temperature. The as-burnt powder was calcined at 500°C as to get more insight in phase formation. As seen, there is no other phase formed in XRD pattern. This result is in agreement with TG-DTA analysis. Agglomeration of the as-burnt BIT particles can be seen in HRTEM micrograph, as shown in Fig. 1. The powder was found to be crystalline from the selected area diffraction (SAD) pattern inserted in the HRTEM micrograph. This confirms the presence crystalline particles. In order to discuss the characteristic of ferroelectric properties, the compacted powders were sintered at different temperature whereby the optimized temperature was achieved at 1000°C. As can be seen in Fig. 2, the hysteresis loop of BIT was relatively good with electrical field. The remanent polarization (P$_r$) and coercive field (E$_c$) were approximately around 7\mu C/cm$^2$ and 30kV/cm, respectively.

CONCLUSIONS
Single step combustion synthesis was successfully used to produce BIT powders with better degree of crystallinity. Several electrical measurements were also performed.

REFERENCES