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ISSN 17426588

<http://iopscience.iop.org/issue/1742-6596/739/1>

## The Effect of Sintering Atmosphere on Electrical Characteristics of Fe<sub>2</sub>TiO<sub>5</sub> Pellet at 1200°C for NTC Thermistor

**Journal of Physics: Conference Series 739 (2016) 012140**

doi:10.1088/1742-6596/739/1/012140

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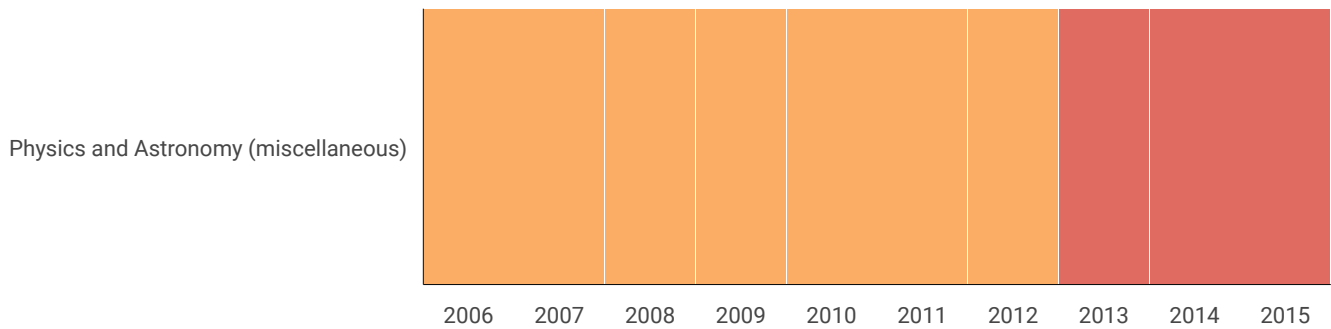
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Country	<a href="#">United Kingdom</a>
Subject Area and Category	<a href="#">Physics and Astronomy</a> <a href="#">Physics and Astronomy (miscellaneous)</a>
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Publication type	Journals
ISSN	17426588
Coverage	2005-ongoing
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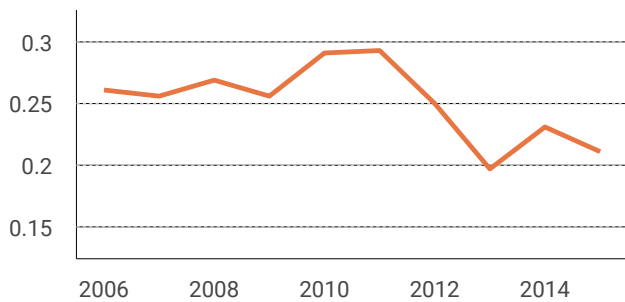
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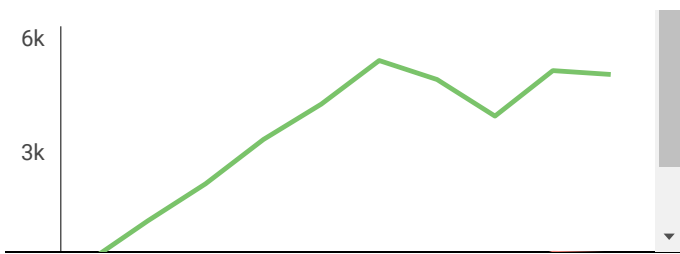


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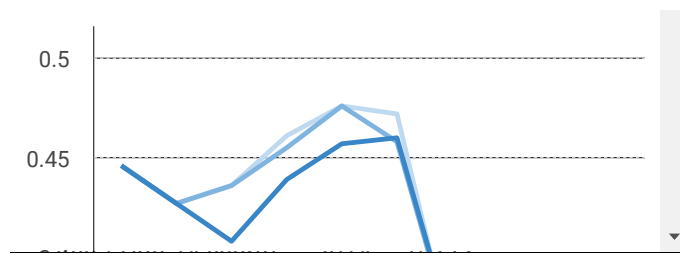
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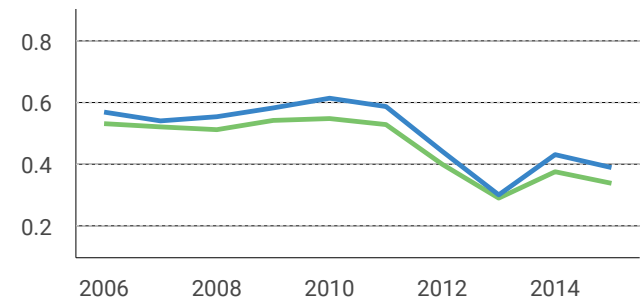


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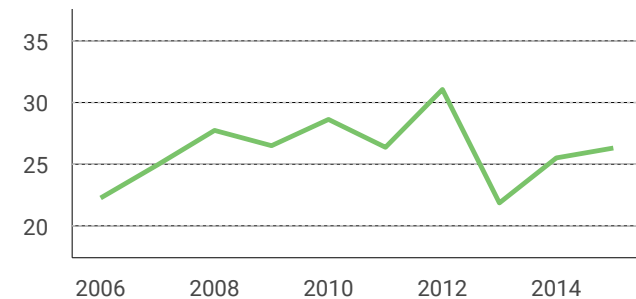


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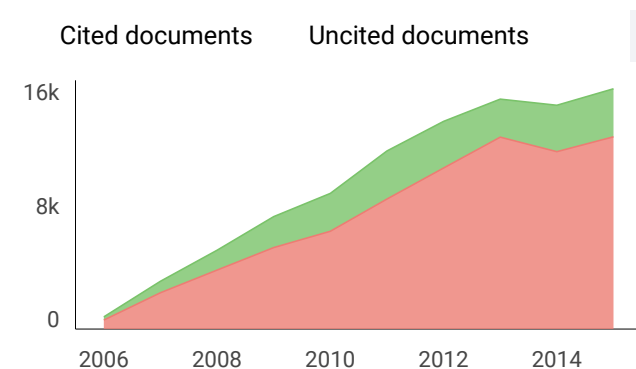
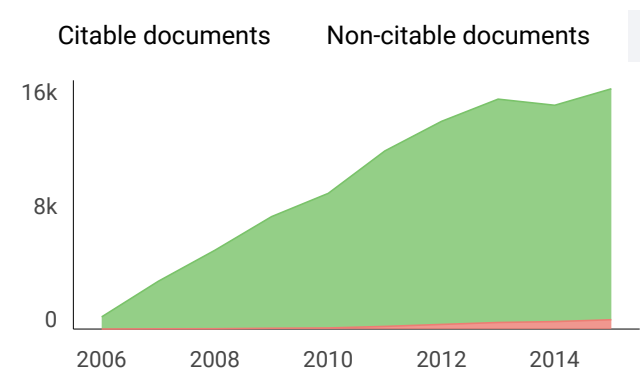
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# The Effect of Sintering Atmosphere on Electrical Characteristics of Fe<sub>2</sub>TiO<sub>5</sub> Pellet Ceramics Sintered at 1200°C for NTC Thermistor

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**Abstract.** Fabrication of Fe<sub>2</sub>TiO<sub>5</sub> pellet ceramics using powder metallurgy technique for NTC thermistor has been carried out, in order to know the effect of sintering atmosphere (Oxygen, Air and Argon Gas) on the characteristic especially the electrical characteristic of Fe<sub>2</sub>TiO<sub>5</sub> ceramics with high working temperature. X-ray diffraction analyses (XRD) was done to know crystal structure and phases formation. A SEM analysis was carried out to know microstructure of pellets. Electrical properties characterization was done through measurement of electrical resistance at various temperatures (room temperature to 250°C). The XRD data showed that the pellets crystallize in orthorhombic. The presence of second phase could not be identified from the XRD analyses. The SEM images showed that the grains size of the ceramic sintered in oxygen gas is smaller than that of the ceramic sintered in air and argon gas. Electrical data showed that the pellet ceramics sintered in oxygen gas had the largest room temperature resistance ( $R_{RT}$ ), thermistor constant ( $B$ ), activation energy ( $E_a$ ) and sensitivity ( $\alpha$ ) compared to those sintered in air and argon gas. From the electrical characteristics data, it was known that the electrical characteristics of the Fe<sub>2</sub>TiO<sub>5</sub> pellet ceramics followed the NTC characteristic. The value of  $B$  and  $R_{RT}$  of the produced Fe<sub>2</sub>TiO<sub>5</sub> ceramics namely  $B = 4389-6149$  K and  $R_{RT} = 342-26548$  k $\Omega$ , fitted market requirement and can be used for temperature sensor.

## 1. Introduction

Negative Temperature Coefficient (NTC) thermistor has been widely used around the world today, due to its capability used in various fields of electronics, such as thermometer, electric current limiter, water flow sensor, and pressure sensor [1-2]. The NTC thermistor is generally made of ceramic having structure of spinel of AB<sub>2</sub>O<sub>4</sub> where A is the ion occupies tetrahedral position and B is the ion occupies octahedral position [3]. Fe<sub>2</sub>TiO<sub>5</sub> ceramic is one of some ceramics that can be applied for NTC thermistor. The thermistor may be produced in the form of disk/pellet or thick film. Here, the object of study is the pellet thermistor.

In this work, a study on fabrication of pellet thermistor based on Fe<sub>2</sub>TiO<sub>5</sub> with sintering atmosphere variation was performed. The effect of sintering atmosphere on the characteristics, especially the electrical characteristics, of the Fe<sub>2</sub>TiO<sub>5</sub> pellet ceramics for NTC thermistor was discussed. Fe<sub>2</sub>TiO<sub>5</sub> is one of semiconductor ceramics used as based material for main components fabrication of NTC thermistor as temperature sensor. The composition of mineral Fe<sub>2</sub>TiO<sub>5</sub> is belong to pseudobrokyte group where the general formula of this compound is X<sub>2</sub>YO<sub>5</sub> with octahedral in both side, X and Y. Generally, Fe<sub>2</sub>TiO<sub>5</sub> has been mostly used for gas sensor, non linear optic, magnetic, catalyst, and microelectronics [4]. Since Fe<sub>2</sub>TiO<sub>5</sub> actually has semi-conductivity, it is very capable to use Fe<sub>2</sub>TiO<sub>5</sub> for NTC thermistor as based material. Thermistor constant  $B$  is a quantity which determine typical characteristic of thermistor corresponding to electrical resistance changes with temperature. The larger

