Review Article

iMedPub Journals
www.imedpub.com

Journal of Polymer science

2021
Vol.7 No.1:210

# Synthesis and characterization of Zinc doped Strontium Titanate

Priyambada Mallick*

Centurion University of Technology and Management, Odisha, India

*Corresponding author: Priyambada Mallick, Centurion University of Technology and Management, Odisha, India, Tel: +9139420985; E-mail: Priyambada@gmail.com

Received date: March 03, 2021; Accepted date: March 17, 2021; Published date: March 24, 2021

Citation: Mallick P (2021) Synthesis and characterization of Zinc doped Strontium Titanate. Polym Sci Vol. 7 No.1:210.



## Abstract

In this work, Synthesis of Zn doped Strontium Titanate was demonstrated by using solid-state reaction technique and polymethyl methacrylate (PMMA) based composites were prepared via solution casting techniques. The microstructure and structure of the resultant compositeswere characterized by SEM (scanning electron microscopy) and XRD (X-ray diffraction) techniques. However, the composites were analyzed at room temperature in a wide range of frequency. Further, high performance Zn doped PMMA composite films would be good candidates for modern electrical and electronic components.

**Keywords:** Solid state reaction, STO (strontium titanate), Ceramic-polymer composite, Perovskite, Impedance.

## Introduction

In recent years, Strontium titanate (STO) has gained a lot of attraction in the field of electronics because of itssignificant electro-chemical properties. It has high dielectric constant, high melting temperature, low coefficient of thermal expansion[1]. It is a ferroelectric perovskite material with face centered cubic structure [2]. Moreover, STO is an important band insulator because it has a band gap = 3.2 eV [3].It plays a vital role in photo-catalysts in solar cells, and solid oxide electronic devices [4]. It has been used in various microwave application because of its dielectric nonlinearity nature (dielectric constant depends on applied electric field) [5]. It has a vast application in the fields of RF filters, hydrocarbon sensors and antennas[6]. Zn Doping can induce the dielectric response of Quality paraelectric STO. Also reveals the photocatalytic activity with improvement of double time than undoped STO. Hence due to the high dielectric constant and low dielectric loss at room temperature Zn doped STO can be applied in microwave devices, tunable capacitors, resonators, phase shifters and oscillators. Zn doped STO There are several methods to synthesize STO butin this work, we have followed solid state method to synthesize Zn doped STO ceramic powders and then made composite of these ceramic-polymers with the help of PMMA polymers by solution casting method and studied about how the Zn doping affects its electrical impedancewhich can give us an idea about the grain boundary, overall electrical properties, relaxation period, bulk properties and the various types of polarization occurring inside the material.

Experimental Technique

The sample Zn doped $SrTiO_3$ was synthesized using solid state reaction technique between high-purity stoichiometry raw materials at high-temperature. The stoichiometrically weighed raw materials was first blended in an air atmosphere for 2 hours and then in alcohol for another 1 hour. Later the mixed powders were calcinated at a temperature of 950oC for 4hr in a high purity alumina crucible. The verification of compound formation was doneusing XRD technique. Calcined powders were then taken according to weight percent (10%, 0.5 gm) with PMMA (5 gm) to prepare the ceramic-polymer composite film. The process was carried out at room temperature by using solution casting method. After the polymerization, using high purity silver paste the two faces of polymer were coated and dried at 100ºC. The structural properties of the samples were identified by XRD. Measurements of dielectric and impedance were studied using an LCR meter computed.

The variation of the real part of modulus with frequency are plotted in Fig.5. It indicates that the value of M′ is almost zero at very low frequency region. Further it rises rapidly with increase in frequency because of the conduction process due to the short-range mobility of charge carriers and also for the absence of therestorative force which dictate the mobility of charge carriers under the action of an induced electric field [8].

The fluctuation of Imaginary part of complex modulus (M") with frequency at room temperature. The value of M" also increases with rise in frequency. The existence of peak in the above plot confirms the relaxation of conductivity in the system i.e. the transition of mobility from long to short range distance. In the low frequency region, the Zinc ions can move quickly from one site to another at a longer distance. But, at higher frequency region, the ions are drifted only at a short distance within a potential well[9]

## Significance of study

The fluctuation of Imaginary part of complex modulus (M") with frequency at room temperature [9]. The value of M" also increases with rise in frequency. The existence of peak in the above plot confirms the relaxation of conductivity in the system i.e. the transition of mobility from long to short range distance. In the low frequency region, the Zinc ions can move quickly from one site to another at a longer distance. But, at higher frequency region, the ions are drifted only at a short distance within a potential well[10-15].

## Conclusion

The perovskite material is prepared by solid state reaction method which is cubical in structure and the polymeric composite films were synthesized by solution casting method. From XRD, the average size of crystallite is found to be 28 nm. The SEM image verifies that the grains are nearly spherical. The average grain size is approximately in between 1-2 µm. The uniform distribution of grains can be seen. The impedance study indicates that AC conductivity increases with rise in frequency. From modulus study hoping mechanism is found in the material with relaxation process. Thus, the prepared material hasa good future in the field of ferroelectric electronics.

## Acknowledgement

No acknowledgement

## References

1. Greenberg MS (2001) Pituitary adenomas: Handbook of Neurosurgery 14: 419-436.
2. David D, Gardner MD, Dolores Shoback MD Greenspan's Basic and Clinical Endocrinology, San Francisco Mc Graw Hill 90-98.
3. Landman RE, Wardlaw SL, McConnell RJ (2001). Pituitary lymphoma presenting as fever of unknown origin. J Clin Endocrinol Metab 86: 1470–1476.
4. Mezosi E, Nemes O (2009) Treatment of pituitary adenomas Orv Hetil 150: 1803-1810.
5. Asa SL, Ezzat S (2002) The pathogenesis of pituitary tumours. Nat Rev Cancer 2: 836 49
6. Selman WR, Laws ER Jr, Scheithauer BW, Carpenter SM (1986) The occurrence of dural invasion in pituitary adenomas. J Neurosurg 64: 402–407.
7. Thapar K, Kovacs K, Scheithauer BW, Stefaneanu L, Horvath E et al. (1996) Proliferative activity and invasiveness among pituitary adenomas and carcinomas: An analysis using the MIB-1 antibody. Neurosurgery 38: 99–107.
8. Kaltsas GA, Nomikos P, Kontogeorgos G, Buchfelder M, Grossman AB (2005) Clinical review: diagnosis and management of pituitary carcinomas. J Clin Endocrinol Metab 90: 3089–3099.
9. DeLellis RA, Lloyd RV, Heitz PU, Eng C (2004) Pathology and Genetics of Tumours of Endocrine Organs. Lyons, France: IARC Press.
10. Chahal HS, Stals K, Unterlander M, Balding DJ, Thomas MG et al. (2011) AIP mutation in pituitary adenomas in the 18th century and today. N Engl J Med 364: 43-50.
11. Asa SL, Ezzat S (2002) The pathogenesis of pituitary tumours. Nat Rev Cancer 2: 836–849.
12. Daly AF, Rixhon M, Adam C, Dempegioti A, Tichomirowa MA et al. (2006) High prevalence of pituitary adenomas: a cross-sectional study in the province of Liege, Belgium. J Clin Endocrinol Metab 91: 4769-4775.
13. Kreutzer J, Buslei R, Wallaschofski H (2008) Operative treatment of prolactinomas: indications and results in a current consecutive series of 212 patients. Euro J Endocrinol 158: 11–18.
14. Daly AF, Rixhon M, Adam C (2006) High prevalence of pituitary adenomas: A cross-sectional study in the province of Liege, Belgium, J Clin Endocrinol Metab 91: 4769–4775.
15. Roessmann U, Kaufman B, Friede RL (1970) Metastatic lesions in the sella turcica and pituitary gland. Cancer 25: 478–480.