Cite this article

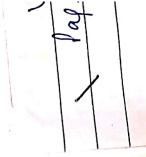
Sharma I, Mahajan S, Arora V er al Effect of a magnetic field on the dielectric properties of PLT-BNCFO composites Emerging Materials Research,

https://doi.org/10.1680/jemmr.22.00183

Research Article Paper 2200183

Received 17/10/2022, Accepted 03/05/2023 First published online 15/05/2023

ICE Publishing: All rights reserved



## **Emerging Materials Research**

ICC Publishing

# Effect of a magnetic field on the dielectric properties of PLT-BNCFO composites Indu Sharma

Department of Physics, Career Point University, Hamirpur, India

#### Shruti Mahajan

Department of Physics, Saroop Rani Government College, Amritsar, India; Multifunctional Materials Laboratory, Department of Physics, Guru Nanak Dev University, Amritsar, India Vishal Arora

Department of Physics, Hindu College, Amritsar, India

#### Mehak Arora

Multifunctional Materials Laboratory, Department of Physics, Guru Nanak Dev University, Amritsar, India

### Nitin Mahajan

Multifunctional Materials Laboratory, Department of Physics, Guru Nanak Dev University, Amritsar, India

#### Kanika Aggarwal

Department of Physics, Sant Longowal Institute of Engineering and Technology, Longowal, India

including sensors, spintronics, transducers and information

storage, because of the coexistence of ferromagnetic and ferroelectric properties. 1-7 This interaction of the magnetic and

### Anupinder Singh

Multifunctional Materials Laboratory, Department of Physics, Guru Nanak Dev University, Amritsar, India (corresponding author: anupinders@gmail.com)

The main goal of this study is to analyze the magnetic, dielectric and magneto-dielectric characteristics of  $Pb_{1-x}La_xTi_{1-x}O_3$ (PLT)–(Ba<sub>1-3x</sub>Nd<sub>2x</sub>)<sub>4</sub>Co<sub>2</sub>Fe<sub>36</sub>O<sub>60</sub> (BNCFO) (where x = 0.25) composite materials T1–T3 sintered at various temperatures (1100, 1200 and 1300°C, respectively). An X-ray diffraction investigation was performed in order to pinpoint the creation of a Utype hexaferrite phase. Scanning electron microscopy micrographs reveal that sample T2 reached the maximum value of grain size and the largest experimental density value of 6.14 g/cm³ due to the intensified grain growth of the composite material. The magnetic investigations further indicate that sample T2 achieved the highest remnant magnetization, measuring 1.550 emu/g, revealing the suitability of the sintering temperature. The magneto-dielectric investigations demonstrate the presence of multiferroicity in all samples and show that sample T2 exhibits the highest magnetodielectric response of 41.99 at 1.2 T and a magneto-dielectric coefficient (2) of around 0.7609 g<sup>2</sup>/emu<sup>2</sup>. Numerous metrics, including Nyquist plots, impedance, electrical modulus, dielectric constant and conductivity, were carefully examined in order to determine the electrical properties of the proposed sample. It was found that sample T2 produced enhanced

Keywords: ceramics/composite materials/impedance spectroscopy/magnetic properties/magneto-dielectric coefficient/magneto-Notation

	Nota	tion		•	
	Α	temperature-dependent constant that gives the	$\varepsilon'(0)$	dielectric constant in the above	
	$rac{f}{H_c}$ .	strength of polarization frequency coercive electric field	$\varepsilon'(H)$	dielectric constant in the absence of a magnetic field dielectric constant in the presence of a magnetic field	
	$K_{\rm B}$ $M$	Boltzmann constant	ε"		
	M*	magnetization complex modulus	E.,	imaginary part of dielectric constant highest frequency	
	M	real part of the electrical model	$rac{arepsilon_{ m s}}{\sigma_{ m ac}}$	lowest frequency	
	$M''$ $M''_{max1}$	imaginary part of the electrical modulus  peak value of M'	$\sigma_{ m de}$	alternating current conductivity direct current conductivity	
	$M_{\omega}$ $M_{I}$	limiting real part of permitting	$\tau$ $\phi(t)$	relaxation time	
	n	remain magnetization	ω	Kohlrausch-Williams-Watts relaxation function frequency	
	Р	amount of interaction between mobile ions and the lattice	$\omega_{(\mathrm{max})}$	maximum value of the frequency at a particular	
		ferroelectric transition temperature real part of the impedance imaginary part of the impedance coefficients of magnetoelectric coupling magneto-dielectric party	1. Introduction		
	Z"		Due to their unique qualities, multifunctional materials are receiving a lot of attention. Multiferroic materials have a significant deal of potential for usage in a variety of applications, storage, because of the		
	γ				
		real part of dielectric constant	storage, b	ecause of the transducers and informer	