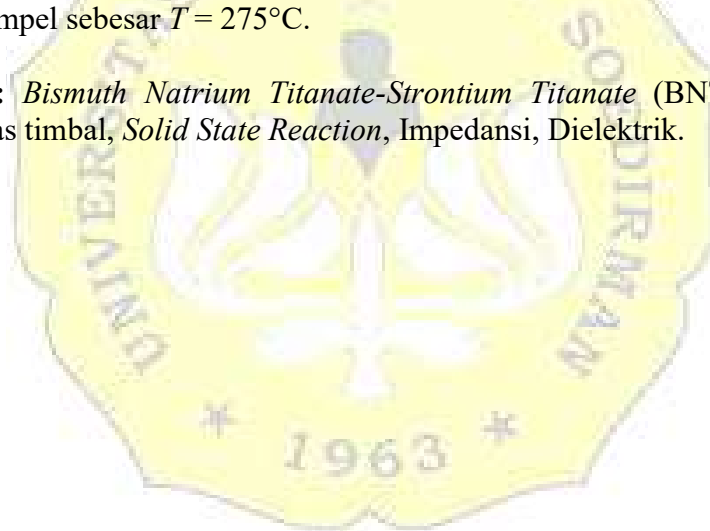


## ABSTRAK

Piezoelektrik merupakan fenomena listrik yang dihasilkan dari material padat dan kristal ketika material itu ditekan atau dikenai gaya eksternal. Material piezoelektrik yang paling banyak digunakan adalah *Lead Zirconate Titanate* (PZT) dengan kandungan 60% Timbal (Pb) dari komposisinya dan memiliki potensi berbahaya bagi lingkungan. Pada penelitian ini telah dilakukan pembuatan dan karakterisasi material piezoelektrik bebas timbal yang ramah lingkungan yaitu *Bismuth Natrium Titanate-Strontium Titanate* (BNT-ST) *doping*  $\text{Mn}_2\text{O}_3$  menggunakan metode *Solid State Reaction*. Variasi konsentrasi *doping*  $\text{Mn}_2\text{O}_3$  adalah 1, 2, 3, dan 4 dalam %mol. Pengujian karakterisasi dilakukan menggunakan *X-Ray Diffraction* (XRD), SEM-EDS, dan *Electrochemical Impedance Spectroscopy* (EIS). Material *Bismuth Natrium Titanate-Strontium Titanate* (BNT-ST) *doping*  $\text{Mn}_2\text{O}_3$  menghasilkan tiga fasa kristal berupa  $\text{Bi}_{0,7}\text{Sr}_{0,3}\text{MnO}_3$ ,  $\text{Bi}_{4,5}\text{Na}_{0,5}\text{Ti}_4\text{O}_{15}$ , dan  $\text{Na}_2\text{Ti}_9\text{O}_{19}$  dengan struktur kristal berturut-turut yaitu orthorhombik, tetragonal, dan monoklinik. Komposisi optimumnya yaitu pada pemberian konsentrasi *doping* 4%mol  $\text{Mn}_2\text{O}_3$  yang memiliki pola difraksi dengan puncak tertinggi di  $2\theta = 32,54^\circ$ , nilai impedansi sebesar  $Z = 0,21 \Omega$ , dan konstanta dielektrik sebesar  $\epsilon_r = 1197$  pada frekuensi tinggi 0,25 MHz dengan temperatur pengujian sampel sebesar  $T = 275^\circ\text{C}$ .

**Kata kunci:** *Bismuth Natrium Titanate-Strontium Titanate* (BNT-ST) *doping*  $\text{Mn}_2\text{O}_3$ , Bebas timbal, *Solid State Reaction*, Impedansi, Dielektrik.



## ABSTRACT

*Piezoelectric is an electrical phenomenon that is produced from solid and crystalline materials when the material is pressed or subjected to an external force. The most widely used piezoelectric material is Lead Zirconate Titanate (PZT) which contains 60% Lead (Pb) of its composition and potentially damaging for environment. In this research has carried out the fabrication and characterization of environmentally friendly lead-free piezoelectric material, namely Bismuth Natrium Titanate-Strontium Titanate (BNT-ST) doping  $Mn_2O_3$  using the solid state reaction method. The variation of  $Mn_2O_3$  doping concentration is 1, 2, 3, and 4 in %mol. Characterization tests were performed using X-Ray Diffraction (XRD), SEM-EDS, and Electrochemical Impedance Spectroscopy (EIS). Material Bismuth Natrium Titanate-Strontium Titanate (BNT-ST) doping  $Mn_2O_3$  produces three crystal phases in the form of  $Bi_{0,7}Sr_{0,3}MnO_3$ ;  $Bi_{4,5}Na_{0,5}Ti_4O_{15}$ ; and  $Na_2Ti_9O_{19}$  with consecutive crystal structures in the form of orthorhombik, tetragonal, and monoclinic. The optimum composition is the doping concentration of 4%mol  $Mn_2O_3$  which has a diffraction pattern with the highest peak intensity at  $2\theta = 32.54^\circ$ , an impedance value of  $Z = 0.21 \Omega$ , and a dielectric constant of  $\epsilon_r = 1197$  at a high frequency of 0.25 MHz with a sample experimental temperature of  $T = 275^\circ C$ .*

**Keywords:** *Bismuth Natrium Titanate-Strontium Titanate (BNT-ST) doping  $Mn_2O_3$ , Lead-free, Solid state reaction, Impedance, Dielectric.*

