SINTESIS DAN KARAKTERISASI SENYAWA AURIVILIUS LAPIS DUA $Ca_{1-x}Sn_xBi_2Nb_2O_9$ MENGGUNAKAN METODE LELEHAN GARAM SEBAGAI MATERIAL FEROELEKTRIK

SKRIPSI SARJANA KIMIA

Oleh:

Ahmad Zaki Habibullah

2110411020

Dosen Pembimbing I : Prof. Dr. Zulhadjri, M.Eng

Dosen Pembimbing II : Dr. Syukri

PROGRAM SARJANA

DEPARTEMEN KIMIA

FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

UNIVERSITAS ANDALAS

PADANG

2025

ABSTRACT

Synthesis and Characterization of Double Layer Aurivilius Compound $Ca_{1-x}Sn_xBi_2Nb_2O_9$ Using Molten Salt Method as Ferroelectric Material

by:

Ahmad Zaki Habibullah (NIM:2110411020)
Prof. Dr. Zulhadjri, M.Eng* , Dr. Syukri*

***Supervisors**

Continuous innovation in modern technology demands the development of dielectric capacitor materials that have high efficiency and thermal stability. One such candidate material is the Aurivillius compound $CaBi_2Nb_2O_9$ (CBN), which has stable ferroelectric properties at high temperatures, but still has weaknesses in its electrical properties, including a relatively low dielectric constant, suboptimal spontaneous polarization, and limited energy storage efficiency. In this study, CBN was modified by substituting Ca^{2+} cations with Sn^{2+} in the compound $Ca_{1-x}Sn_xBi_2Nb_2O_9$ (x = 0,025; 0,05; 0,075; 0,1; 0,15) to improve its electrical properties and storage efficiency. Synthesis was carried out using the salt melt method with a mixture of NaCl/KCl in a molar ratio of 7:1 to the precursor. Characterization using XRD showed that all samples had a single phase while the diffraction pattern shifted towards a smaller diffraction angle. Le Bail refinement analysis confirmed that the crystal structure was orthorhombic ($A2_1am$), and the lattice parameter values showed that the structural distortion due to doping did not cause significant structural changes. FTIR analysis confirmed that Sn^{2+} ions were doped at site A. To further study the bond structure at site A, Raman spectroscopy analysis was carried out and it was found that the effect of Sn^{2+} doping causes vibration weakening in the perovskite layer and some of the Sn^{2+} appears to enter the bismute layer.The band gap energy value obtained from UV-Vis DRS decreased from 3,19 eV to 3,15 eV with increasing Sn^{2+}, indicating modification of the electronic band due to the role of Sn^{2+} valence electron orbitals. SEM morphology shows a layered plate-like structure and smaller grain size in line with the increasing sample density. The dielectric property analysis results show an increase in the dielectric constant and a decrease in the Curie temperature (T_c), with the emergence of relaxor properties at $x \geq 0,1$. Ferroelectric analysis results show a slimmer *P-E* curve and an increase in energy storage efficiency (η) due to the increase in Sn^{2+} doping composition, with the highest value of 80,94% at x = 0,15. These results indicate that the Aurivillius compound $Ca_{1-x}Sn_xBi_2Nb_2O_9$ has potential for application in environmentally friendly dielectric capacitor materials, with good thermal stability under extreme conditions.

***Keywords**: Aurivilius, ferroelectric, energy storage, molten-salt method, Le Bail Refinement.*