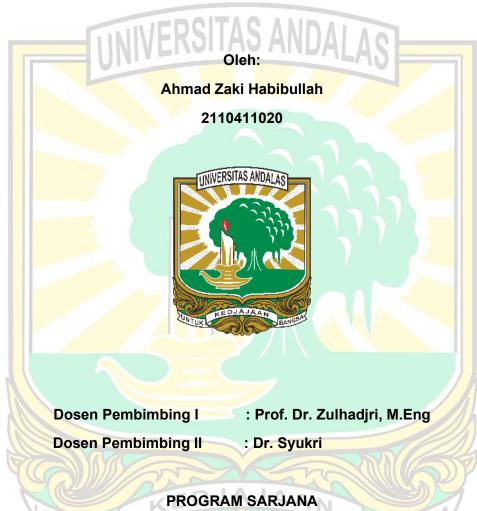
SINTESIS DAN KARAKTERISASI SENYAWA AURIVILIUS LAPIS DUA Ca_{1-x}Sn_xBi₂Nb₂O₉ MENGGUNAKAN METODE LELEHAN GARAM SEBAGAI MATERIAL FEROELEKTRIK

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ABSTRACT

Synthesis and Characterization of Double Layer Aurivilius Compound Ca_{1-x}Sn_xBi₂Nb₂O₉ Using Molten Salt Method as Ferroelectric Material

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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 CaBi₂Nb₂O₉ (CBN), which has stable ferroelectric properties at high temperatures, but still has weaknesse<mark>s in its electrical pr</mark>operties, including a relatively low dielec<mark>tric con</mark>stant, suboptimal spontaneous polarization, and limited energy storage efficiency. In this study, CBN was modified by substituting $\frac{\text{Ca}^2}{\text{Cations}}$ with Sn^2 in the compound $\text{Ca}_{1-x}\text{Sn}_x\text{Bi}_2\text{Nb}_2\text{O}_9$ (x = 0,025; 0,05; 0,075; 0,1; 0,15)to improve i<mark>ts e<mark>lectrical pro</mark>perties and s<mark>tor</mark>age efficiency. Synthesis was carried o<mark>ut using t</mark>he salt melt</mark> 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 a<mark>ngle. Le Bail r</mark>efinement analysis confirmed that the crystal structure <mark>was</mark> orthorhombic (A2₁am), and the lattice parameter values showed that the structural distortion due to doping did not cause signif<mark>ic</mark>ant structural changes. FTIR analysis confirmed that Sn²⁺ 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 Sn²⁺ doping causes vibration weakening in the perovskite layer and some of the Sn²⁺ 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 Sn²⁺, indicating modification of the electronic band due to the role of Sn²⁺ 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 $x \ge 0,1$. Ferroelectric analysis results show a slimmer P-E curve and an increase in energy storage efficiency (η) due to the increase in Sn²⁺ 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.