COMPARISON ON STRUCTURAL, MORPHOLOGICAL AND ELECTRICAL ANALYSIS ON Mn AND Zn-DOPED KNN THIN FILM BY SOL-GEL METHOD

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Abstract

The lead-free sodium potassium niobate (KNN) exhibits improved electrical and structural properties. This substance is well-known because it resembles lead zirconate titanate (PZT). KNN may replace the commonly used PZT, although it has significant drawbacks. This study introduced metal oxide doping. The perovskite structure of KNN contained manganese oxide (MnO) and zinc oxide (ZnO) dopants. The improved electrical characteristics of KNN thin films doped with MnO and ZnO were investigated by studying the effects of manganese and zinc dopants on the surface morphology and resistivity. The

chemical solution deposition was used as methodology. Their structural, morphology and electrical properties of the doped KNN thin film were analysed using X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), and LCR meter. The peak of all KNN thin films was in the (001), indicating a preferred for growth orientation. Mn-doped KNN films had improved crystallinity and suppressed secondary phases, while ZnO doping preserved the crystal structure with only minor disturbances. The microstructure of Mn-doped KNN thin films was homogeneous and dense with reduced grain boundaries, while Zn-doped KNN thin films had a denser morphology and bigger grain sizes, especially at higher doping levels. The electrical measurements showed that Mn doping increases resistivity, making films better for high-performance piezoelectric applications. Conversely, the incorporation of zinc resulted in a reduction in the electrical resistance of the material as its concentration increased. The work shows that Mn and Zn doping affects KNN thin film structural, morphological, and electrical properties differently. The results showed that MnO-doped KNN performed best at a concentration of 0.3 mol and ZnO-KNN at 0.9 mol. These results aid the development of improved KNN-based materials for electrical and piezoelectric applications.

Author keywords

doped; KNN; structural; thin film

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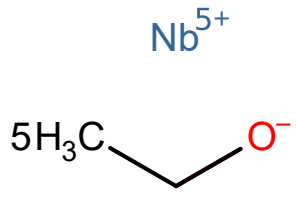

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