

Crystal growth and characterization of lead-free based Cu-doped $K_{0.48}Na_{0.52}NbO_3$ fibers by micro-pulling-down

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Lead zirconate titanate (PZT) ceramics are extensively used in piezoelectric transducer devices due its good piezoelectric properties and high Curie temperature. However, because of the toxicity of Pb element, it is necessary the development of new piezoelectric compositions with the similar electrical characteristics. In addition, it is well-known that piezoelectric single crystals present much better electrical properties than their counterpart ceramics. Among the most promising lead-free materials for piezoelectric applications sodium potassium niobate (KNN) is considered a potential candidate to replace the PZT compounds [1]. In this work undoped and Cu-doped KNN single crystal fibers with compositions near the morphotropic phase boundary (MPB) were grown by the micro-pulling-down technique (μ -PD) under three different atmospheres atmosphere: air, oxygen and argon. The μ -PD technique is a promising route because it allows obtaining crystals in a short period of time by using a reduced amount of raw materials [2]. It was verified that experimental parameters such as nozzle geometry, crucible features, temperature gradient and pulling rate were crucial for the growing of the crystals. Furthermore, it was also noticed that the atmosphere had an important impact on the crystal quality. Despite the challenges, pure and Cu-doped KNN crystals were grown and their dielectric and piezoelectric properties were investigated. Our results demonstrated that the μ -

PD method is suitable for growing good KNN crystals for technological applications.

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References

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