

Sodium Potassium Niobate Based Eco-Friendly Lead-free Piezoceramics: Effects of Dopants on the Electrical Properties

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Poor electrical reproducibility in $K_{0.5}Na_{0.5}NbO_3$ (KNN) ceramics is one of the main drawbacks in the widespread use of these lead free ceramics in many commercial applications. In this study, we aimed to improve electrical reproducibility by using various oxide dopants. For this purpose, the neat and ZnO-SnO₂, Sb₂O₅ and Yb₂O₃ doped $K_{0.5}Na_{0.5}NbO_3$ in the presence of a liquid phase provider, like $K_4CuNb_8O_{23}$ (KCN) were prepared by conventional ceramic processing. The electrical and electro-mechanical properties of ceramics sintered at their optimum sintering conditions were studied in detail. Interestingly, each dopant had individual effects on the electrical properties of KNN-KCN system. Decreasing the electrical/mechanical loss, increasing d_{33} values from 90 to 115pC/N, virtually hysteresis-free unipolar strain-electrical field curves were observed. Some electrical properties were enhanced without degrading electrically "hard" character in KNN-KCN ceramics by various doping. In summary, modified KNN-KCN based piezoceramics with hard character are good potential for the high power applications working under heavy electrical and mechanical stresses.

Keywords: Lead-free piezoceramics, $K_{0.5}Na_{0.5}NbO_3$, Perovskite, Electrical Properties, Hard Character