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Effects of Co-Doping on Dielectric and Electrical Responses of $CaCu_3Ti_{4-x}(Nb_{1/2}In_{1/2})_xO_{12}$ Ceramics

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In this work, $CaCu_3Ti_{4-x}(Nb_{1/2}In_{1/2})_xO_{12}$ ceramics with x = 0, 0.025, 0.05, 0.10, and 0.20 were prepared by a conventional solid state reaction method. Changes in crystal structure, microstructure, dielectric, and electrical properties were systematically investigated. The main phase of $CaCu_3Ti_4O_{12}$ ceramic was clearly observed in all the samples. The average grain size of $CaCu_3Ti_4O_{12}$ decreased by (Nb^{5+}+In^{3+}) doping. The dielectric permittivity of $CaCu_3Ti_{4-x}(Nb_{1/2}In_{1/2})_xO_{12}$ ceramics was slightly dependent on frequency as co-doping concentration increased, which was due to a decrease in grain size. Dielectric behavior can be well described by the internal barrier layer capacitor (IBLC) model based on the interfacial polarization at grain boundaries. By using an impedance spectroscopy analysis at various temperatures, it was found that the grain boundary resistance and potential barrier height at the grain boundary of $CaCu_3Ti_4O_{12}$ were reduced by co-doping with (Nb^{5+}+In^{3+}) ions, resulting in an enhancement of dc conductivity and the related dielectric loss tangent.

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