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Dielectric and non-ohmic properties of Ca2Cu2-xGexTi4O12 ceramic composites

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In this work, the dielectric and non-Ohmic properties of $Ca_2Cu_2 - xGe_xTi_4O_12$ ($CaCu_3Ti_4O_12/CaTiO_3$ composite) ceramic with additions of GeO_2 (x = 0, 0.025, 0.050 and 0.100) were prepared using a solid□state reaction method. X-ray diffraction technique was used to confirm the second phases of CaCu3Ti4O12 and CaTiO3 phases was detected in all the ceramics. The slight decrease in the grain sizes of $Ca_2Cu_2 - xGe_xTi_4O_12$ ceramics can be observed using a scanning electron microscopy. The results revealed that ceramics sintered at 1060 ℃ for 6 h exhibited slightly different dielectric permittivity (˜ 1784 –2645), and the dielectric loss tangent was still very low (˜ 0.036 –0.018) at 1 kHz. This should be associated to insulating grain boundaries with activation energies of 0.80 eV by substitution of $Ge^(4+)$ for x = 0.050. The electrical responses of grains boundaries and internal interfaces were investigated using impedance spectroscopy. Strongly enhanced dielectric responses and variation in nonlinear electrical properties can be well described based on the electrical responses at internal interfaces of the ceramic composites.

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