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Ultrahigh Thermal Stability of Dielectric Permittivity in $0.6Bi(Mg_{1/2}Ti_{1/2})O_3$-$0.4Ba_{0.8}Ca_{0.2}(Ti_{0.875}Nb_{0.125})O_3$

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Abstract : 0.6Bi(Mg1/2Ti1/2)O3-0.4Ba0.8Ca0.2(Nb0.125Ti0.875)O3 (0.6BMT-0.4BCNT) ceramics with a pseudo-cubic structure and re-entrant dipole glass behavior have been investigated via X-ray diffraction and dielectric permittivity-temperature spectra. It shows an excellent dielectric-temperature stability with small variations of dielectric permittivity (± 5%, 420 - 802 K) and dielectric loss tangent (tanδ < 2.5%, 441 - 647 K) in a wide temperature range. Three dielectric anomalies are observed from 290 K to 1050 K. The low-temperature weakly coupled re-entrant relaxor behavior was described using Vogel-Fulcher law and the new glass model. The mid- and high-temperature dielectric anomalies are characterized by isothermal impedance and electrical modulus. The activation energy of both dielectric relaxation and conductivity follows the Arrhenius law in the temperature ranges of 633 - 753 K and 833 - 973 K, respectively. The ultrahigh thermal stability of the dielectric permittivity is attributed to the weakly coupling of polar clusters, the formation of diffuse phase transition (DPT) and the local phase transition of calcium-containing perovskite.

Keywords : permittivity, relaxor, electronic ceramics, activation energy
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