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Triggering Incipient Ferroelectricity in Calcium Copper Titanate (CaCu$_3$Ti$_4$O$_{12}$) ceramics through partial B-site substitution with Te$^{4+}$ ion. NABADYUTI BARMAN, student, K.B.R VARMA, Retired — Double perovskite structured dielectric ceramic CaCu$_3$Ti$_{4-x}$Te$_x$O$_{12}$ (CCTTO) ($x = 0, 0.05, 0.1, 0.15, 0.2$) was fabricated from the powder obtained by conventional solid state synthetic route. The room temperature XRD patterns for the $x = 0, 0.05, 0.075$ modified samples were confirmed to possess a single phase with cubic space group $Im3$ by Rietveld refinement. But, the Rietveld refinement performed on XRD patterns recorded for the compositions corresponding to $x = 0.1, 0.15, 0.2$ shows the coexistence of the cubic phase (space group $Im3$; $a = 7.4065\text{Å}$) and tetragonal phase (space group $I4/mcm$; $a = 7.369\text{Å}$ and $c = 6.967\text{Å}$). The dielectric properties of these ceramics were studied over a wide frequency ($40\text{Hz}-2\text{MHz}$) and temperature range ($30-400\text{K}$). The Te$^{4+}$ doped samples (CCTO) exhibited dielectric permittivity ($\varepsilon_r$) value of $\sim 23-33\times10^3$ which is more than twice that of undoped CCTO ($\sim 11\times10^3$) at 1kHz. A decreasing trend in dielectric permittivity with increasing temperature, a signature of incipient ferroelectricity, was observed for all the samples. Barrett’s formula was invoked to rationalize the dielectric permittivity variation as a function of temperature. The incipient ferroelectric behavior is correlated with soft phonon mode observed in temperature dependent Raman Spectroscopic studies.

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