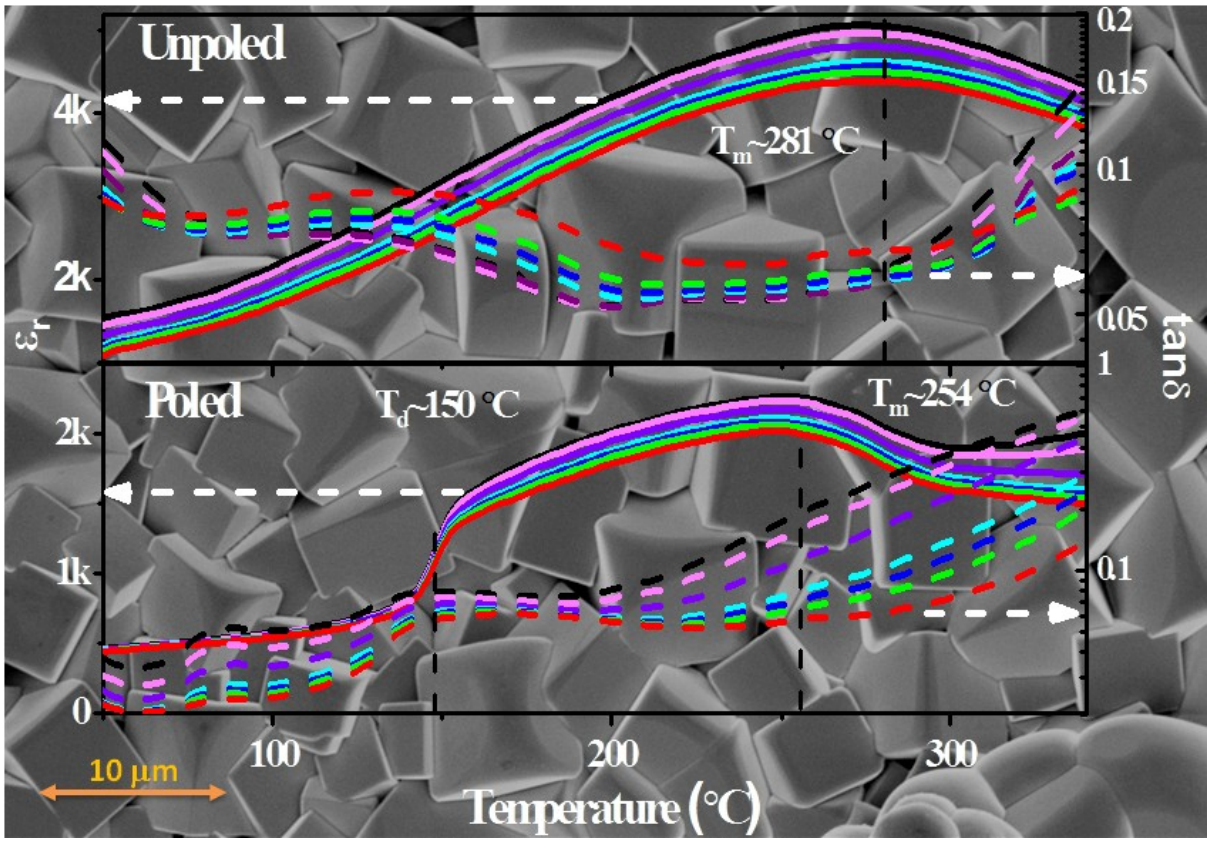
Discipline of Physics:



Lead-free, single phase, piezoelectric $Na_{0.47}Bi_{0.47}Ba_{0.06}Ti_{(1-x)}V_xO_3$ ($0 < x < 0.03$) polycrystalline powders were successfully synthesized using modified sol-gel method. Structural analysis of synchrotron radiation source powder x-ray diffraction data confirmed the rhombohedral *R3c* phase for unpoled samples at ambient temperature, due to a long-range order established in lattice system after poling. V^{+5} doping increases the rhombohedral distortion in unpoled and poled samples while it reduces the tetragonality in poled samples. Vibrational studies confirmed that unpoled samples have more lattice disorder compared to poled samples. X-ray absorption near edge spectroscopy measurement confirmed that Ti and V in 4+ and 5+ oxidation states for all poled and unpoled samples and their pre-edge feature increased after poling. Microstructure analysis showed that average grain size was found to decrease due to reduction in oxygen vacancies by the donor doping, from 5.6 6 0.5 lm to 1.0 6 0.2 lm for x ¼ 0 and 0.03, respectively. Depolarization temperature (T_d) was found to increase significantly in poled samples from 104°C for undoped sample to 150°C for sample with 1% vanadium substitution. Drastic improvements in ferroelectric and dielectric properties were explained in terms of structural changes. Large Remnant polarization (P_r) ~31.4 □C/cm2 and moderately low E_c ~20 kV/cm were observed at maximum applied electric ~35 kV/cm for the sample with 1% vanadium substitution which makes it an attractive candidate for energy conversion applications.

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