Alberto Moure
Patricia Val-Gómez, Adolfo del Campo, José Francisco Fernández, Fernando Rubio-Marcos
Electroceramics Department, Instituto de Cerámica y Vidrio, CSIC, Kelsen 5, 28049 Madrid, Spain
Contact@E-mail alberto.moure@icv.csic.es

Stress dynamics during O-T phase transitions in lead-free KNN-based piezoelectric ceramics studied by Confocal Raman Spectroscopy

In this study, we have investigated by Raman Spectroscopy the stress dynamics arising from the Orthorhombic-Tetragonal Polymorphic Phase Boundary (PPB) in lead-free potassium sodium niobate (KNN)-based ceramics and its temperature dependence, as a means to elucidate the characteristics of PPBs in lead-free piezoelectric oxides. The dynamics are dictated by the phase transitions that occur upon cooling from the cubic phase and the coexistence of different crystal structures. Our findings reveal that the growth of Orthorhombic phases is constrained by the high-temperature tetragonal phase distributions. In particular, it is evidenced that two main mechanisms regulate the decrease of stress processes in which structural and microstructural effects are correlated; the first one is associated to a purely microstructural effect in which bimodal grain distribution hinders the formation of non-180° domains. By contrast, the second is mainly governed by ferroelectric domain distribution and the occurrence of pseudo-cubic regions around room temperature associated with local structural heterogeneity (that is, polar nano regions, PNRs). Specifically, these mechanisms generate regions with different stress state and explain the widening of the phase transition due the phase coexistence (Figure 1).

Figures

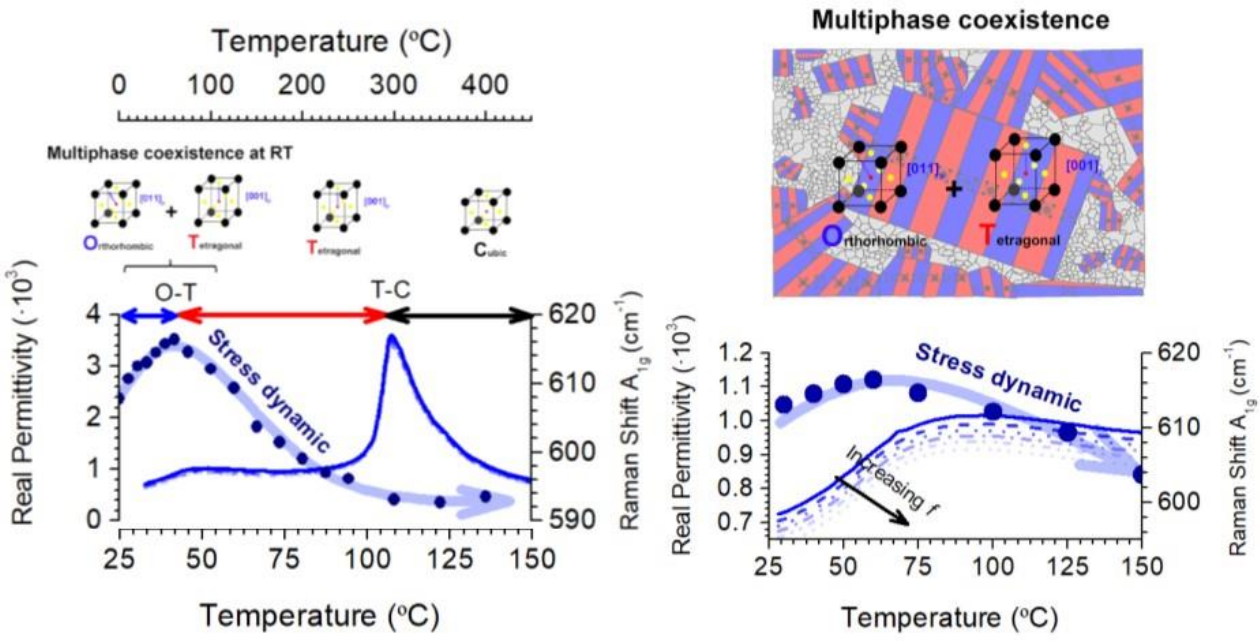

Figure 1: Relations stress/widening of phase transitions due to phase coexistence