Electronic Supplementary Material (ESI) for RSC Advances.
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Supplementary supporting Documents

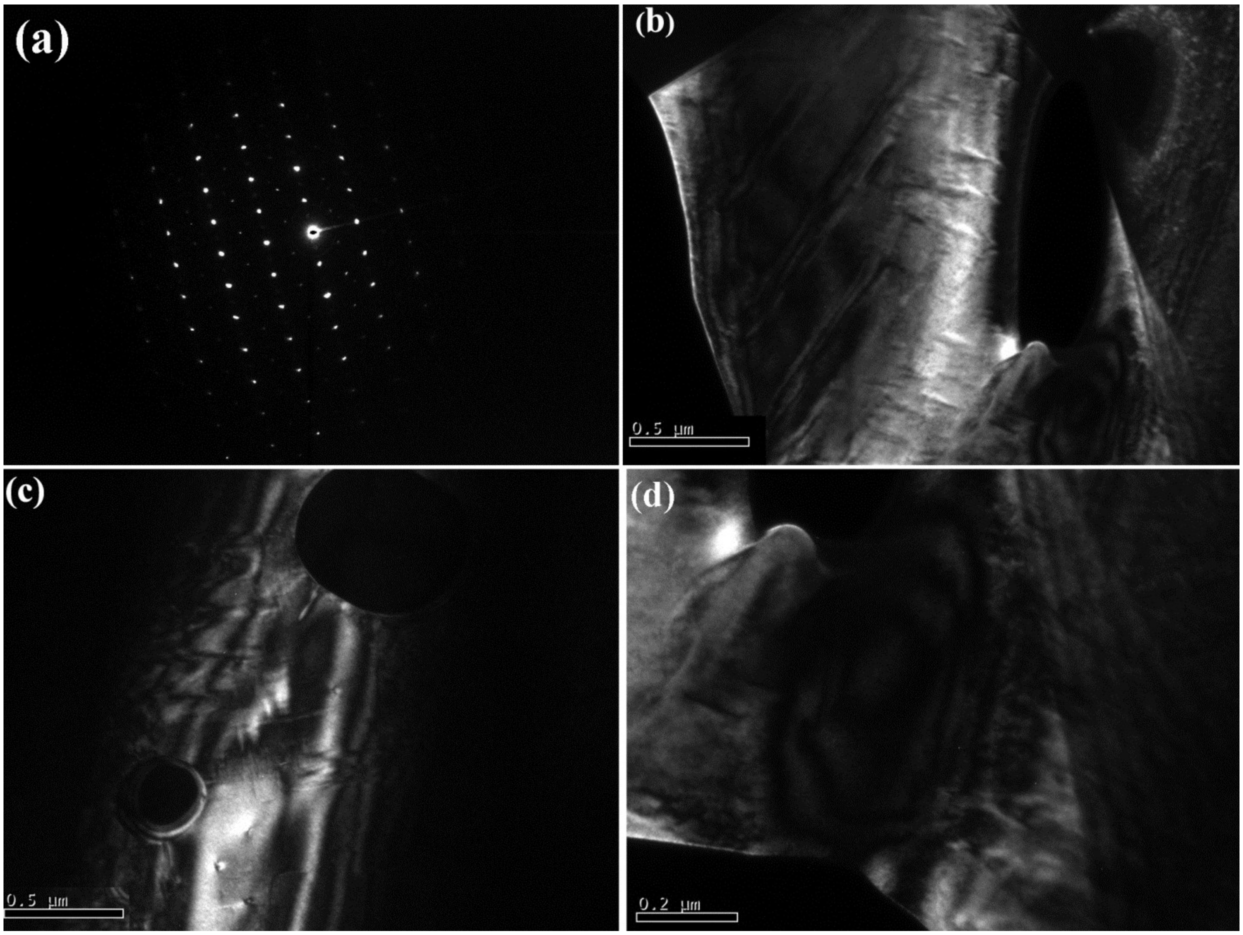

Fig.1. ⟨111⟩ zone axis diffraction patterns from $Sr_{(1-3x/2)}Ce_xTiO_3$ (x = 0.5) ceramics: (a) For powder sample at x = 0.5, and (b) The dark TEM images [Fig. 2(c) – (d), x = 0.5] reveals the presence of planar like defects similar to those reported as long range ferroelectric domains in Ba-based compositions by Stennett et al.[14-15]

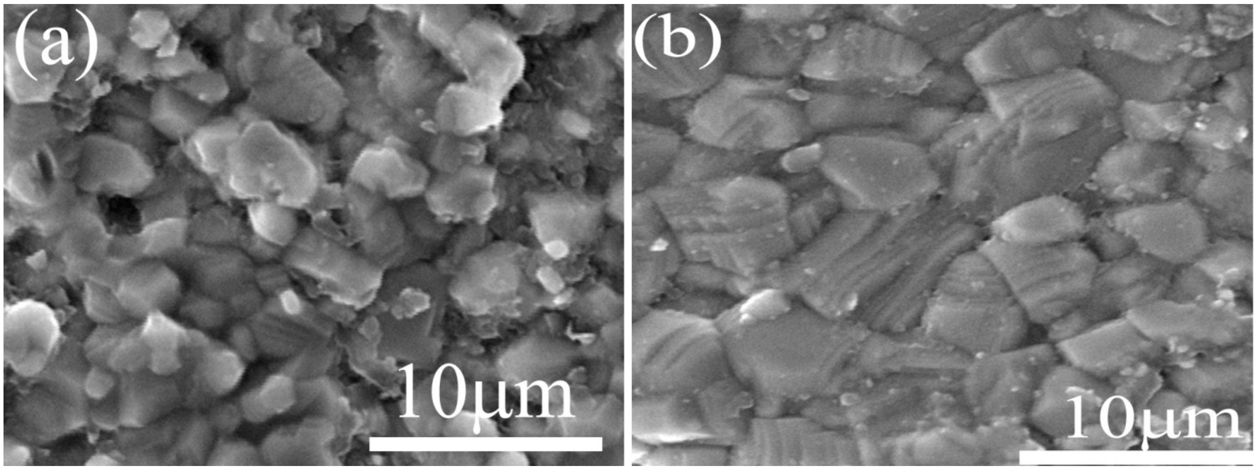

Fig. 2. Scanning electron microscope images of the sintered unpolished samples surfaces of $Sr_{(1-3x/2)}Ce_xTiO_3$ ceramics: (a) $x = 0.1$, and (b) $x = 0.2$.

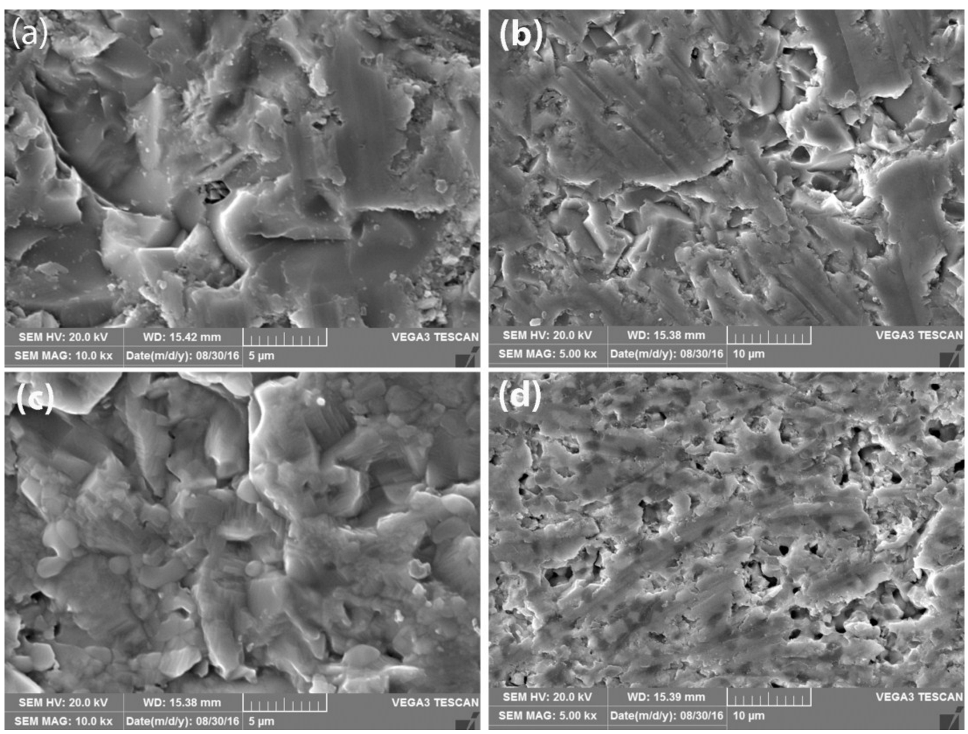

Fig. 3 Scanning electron microscope images of the selected polish sintered samples surfaces of $Sr_{(1-3x/2)}Ce_xTiO_3$ ceramics: (a) $x = 0.3$, (b) $x = 0.4$, (c) $x = 0.5$, and (d) $x = 0.6$.

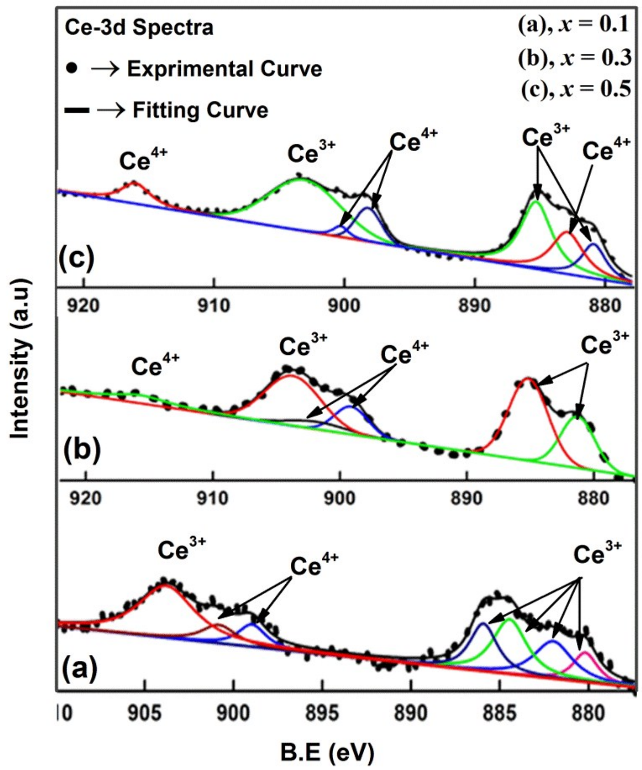

Fig.4. XPS spectra of Ce-3d peaks for SCT ceramics sintered in nitrogen at 1300 °C with different Ce doping levels of: (a) $x = 0.1$, (b) $x = 0.3$, (c) $x = 0.5$.

Based on X-ray photoelectron spectroscopy (XPS) analysis, the Ce-3*d* binding energy regions indicated that all of the samples contained a cluster of Ce^{3+} ions ($Ce^{3+} \geq 95$ % and $Ce^{4+} \leq 5$ %) on the surface of sintered samples.[1, 2]

[1] B. Ullah, W. Lei, Q. S. Cao, Z.Y. Zou, X. K. Lan, X. H. Wang, W. Z. Lu, "Structure and Microwave Dielectric Behavior of A-Site Doped $Sr_{(1-1.5x)}Ce_xTiO_3$ Ceramics System," J. Am. Ceram. Soc., 2016, doi: 10.1111/jace.14341.

[2] G. Subodh, J. James, M. T. Sebastian, R. Paniago, A. Dias, and R. L. Moreira, "Structure and Microwave DielectricProperties of $Sr_{2+n}Ce_2Ti_{5+n}O_{15+3n}$ ($n \leq 10$) Homologous Series," *Chem. Mater.,***19**[16] 4077- 4082 (2007).

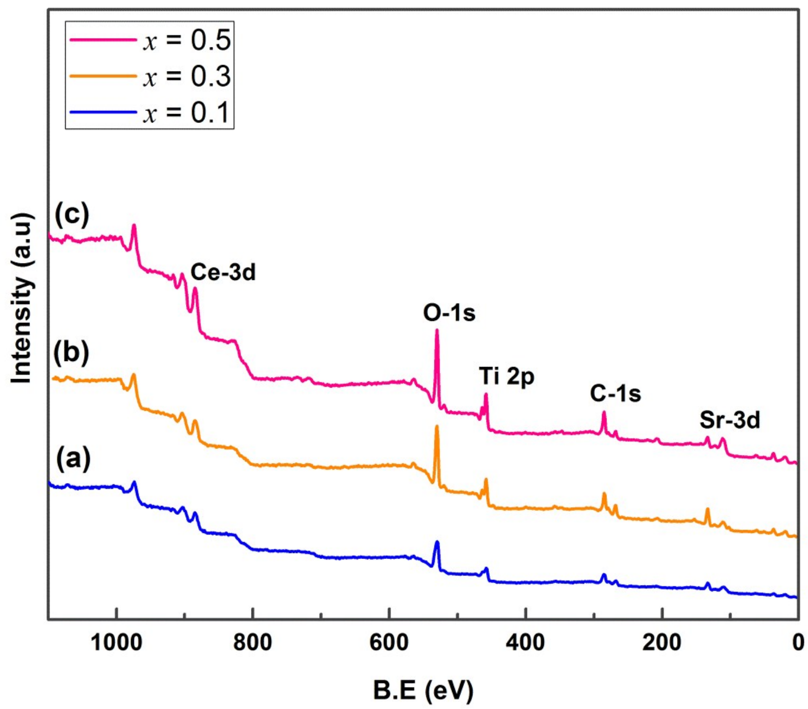

Fig.5. XPS experimental spectra of Ti–2p, Ce-3d, and O–1s core line for $Sr_{(1-3x/2)}Ce_xTiO_3$ ceramics with (a) $x = 0.1$, (b) $x = 0.3$, and (c) $x = 0.5$.

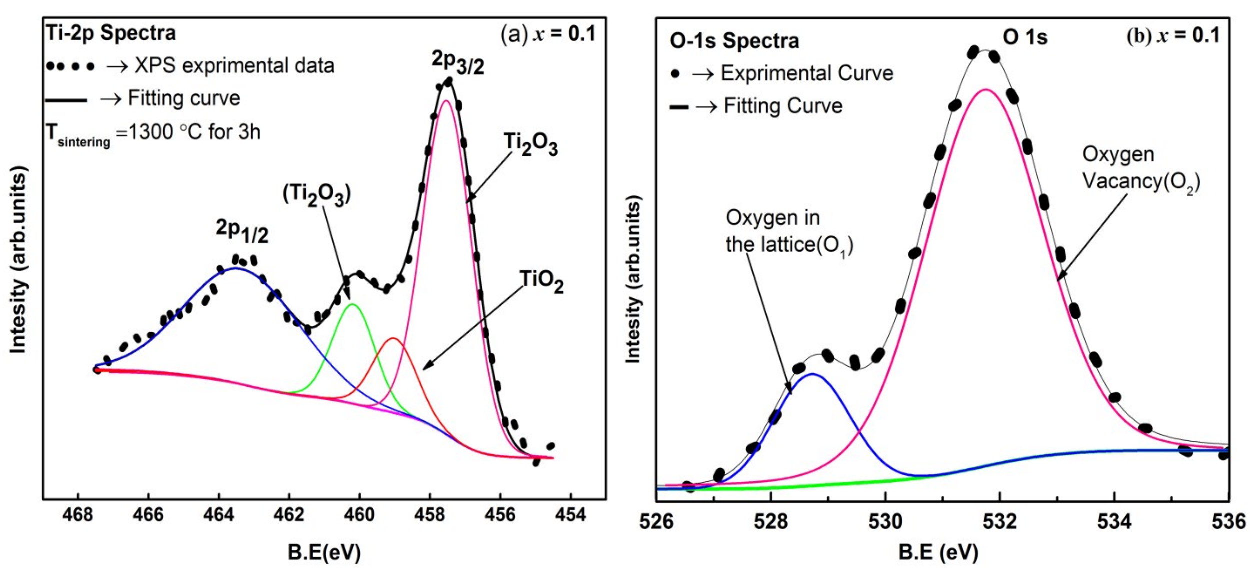

Fig.6. XPS spectra of: (a) Ti–2p, and (b) O–1s core line for $Sr_{(1-3x/2)}Ce_xTiO_3$ ceramics with (a) $x = 0.1$, and (b) $x = 0.1$.

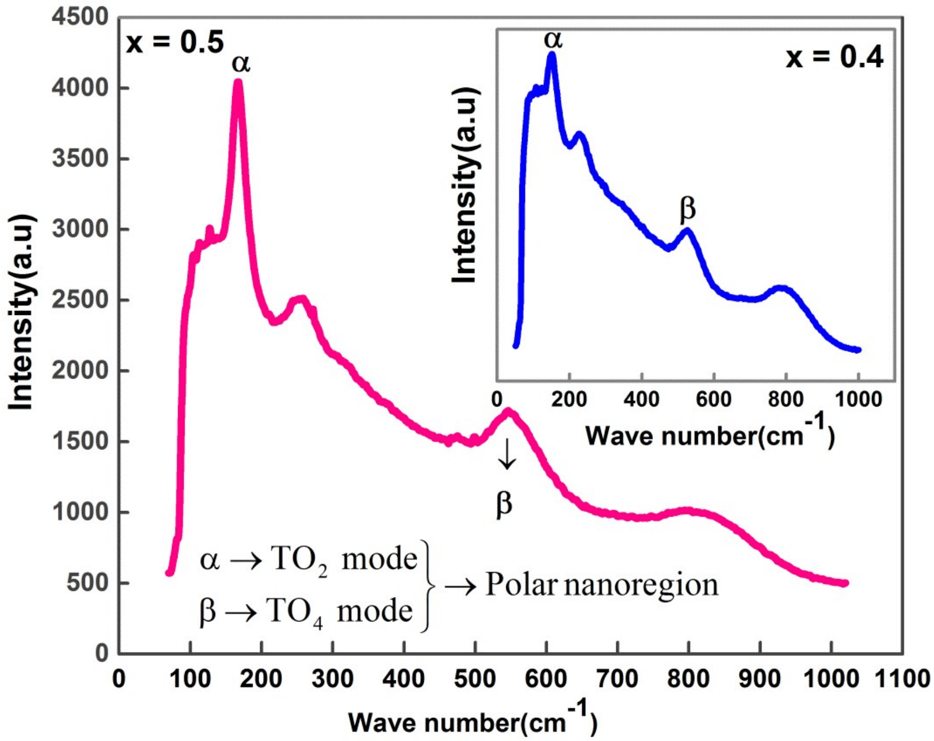

Fig.7. Room temperature Raman spectra of the sintered polished samples surfaces of $Sr_{(1-3x/2)}Ce_xTiO_3$ ceramics at x = 0.5. The peaks indicated as follows: α ~174 cm^{-1} and β ~ 540cm^{-1} reveals the presence of polar nanoregions (PNRs) similar to those reported by Bianchi et al.[1], Toulouse et al.[2], DiAntonio et al.[3], Barker et al.[4], Sirenko et al.[5], and Ranjan et al.[6]

1 U. Bianchi, W. Kleemann, and J. G. Bednorz, "Raman Scattering of Ferroelectric $Sr_{1-x}Ca_xTiO_3$, x= 0.007," *J. Phys. Condns. Matter*, 1994, 6, 1229–38.

2 J. Toulouse, P. DiAntonio, B. E. Vugmeister, X. M. Wang, and L. A. Knauss, "Precursor Effects and Ferroelectric Macroregions in $KTa_{1-x}Nb_xO_3$ and $K_{1-y}Li_yTaO_3$," *Phys. Rev. Lett*. 1992, 68, 232-235.

3 P. Di Antonio, B. E. Vugmeister, J. Toulouse, and L. A. Boatner, "Polar Fluctuations and First-Order Raman Scattering in Highly Polarizable $KTaO_3$ Crystals With Off-Center Li and Nb Ions," Phys. Rev. B, 1993, 47,5629-5637.

4 A. S. Barker, Jr., Temperature Dependence of the Transverse and Longitudinal Optic Mode Frequencies and Charges in $SrTiO_3$ and $BaTiO_3$," *Phys. Rev*. 1966, 145, 391-399.

5 A. A. Sirenko, I. A. Akimov, J. R. Fox, A. M. Clark, H. C. Li, W. Si, and X. X. Xi, "Observation of the First-Order Raman Scattering in $SrTiO_3$ Thin Films," Phys. Rev. Lett. 1999, 82(22):4500-4503.

6 R. Ranjan, R. Hackl, A. Chandra, E. Schmidbauer, D. Trots, and H. Boysen, "High-Temperature Relaxor Ferroelectric Behavior in Pr- Doped $SrTiO_3$," *Phys. Rev. B.,* 2007, 76, 224109 (1-6).