Supplementary Materials for

Origin of ultra-wide temperature dielectric stability and dynamic behavior of nanoregions in $0.6Bi(Mg_{0.5}Ti_{0.5})O_3$-$0.4Ba_{0.8}Ca_{0.2}(Ti_{0.875}Zr_{0.125})O_3$

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Captions of Figures

Fig. S1. Sketch of the dynamics of two kinds of PNRs of a re-entrant relaxor. Comparison of comprehensive dielectric properties of 0.6BMT-0.4BCZT and $0.6Bi(Mg_{0.5}Ti_{0.5})O_3$-$0.4Ba_{0.8}Ca_{0.2}TiO_3$ (0.6BMT-0.4BCT);[1] $0.6Bi(Mg_{0.5}Ti_{0.5})O_3$-$0.4Ba_{0.8}Ca_{0.2}(Ti_{0.875}Nb_{0.125})O_3$ (0.6BMT-0.4BCNT);[1] $0.82(0.94Na_{0.5}Bi_{0.5}TiO_3$-$0.06BaTiO_3)$-$0.18K_{0.5}Na_{0.5}NbO_3$ [0.82(0.94NBK-0.06KBT)-0.18KNN];[2] $0.75K_{0.5}Bi_{0.5}TiO_3$-$0.25BiScO_3$ (0.75KBT-0.25BS) ;[3] $Bi_{05}Na_{0.5}TiO_3$-$0.03Yb_2O_5$ (BNT-0.03Yb) for 1 MHz.[4]

Fig. S2. (a) The surface SEM images of 0.6BMT-0.4BCZT; (b)The statistic distributions of the gain size in ceramics using Gauss distribution.

Fig. S3. (a) HRTEM image of using Inverse Fourier transform, (b) nano-scale-ordered structure and (c), (d) disorder structure.

Fig. S4. Variation of the gray value of the corresponding (a), (b), (c) and (d) HRTEM images presented in Fig. S3.

Fig. S5. (a) Temperature dependence of main relaxation time according to the M'' peak. The purple line is the the Arrhenius and Volgel-Fulcher fitting, (b) permittivity variation of the ratio of $\varepsilon_{\infty}(T)$ to $\varepsilon_{1\ MHz}(T)$ as a function of temperature in the 633 K to 973 K.

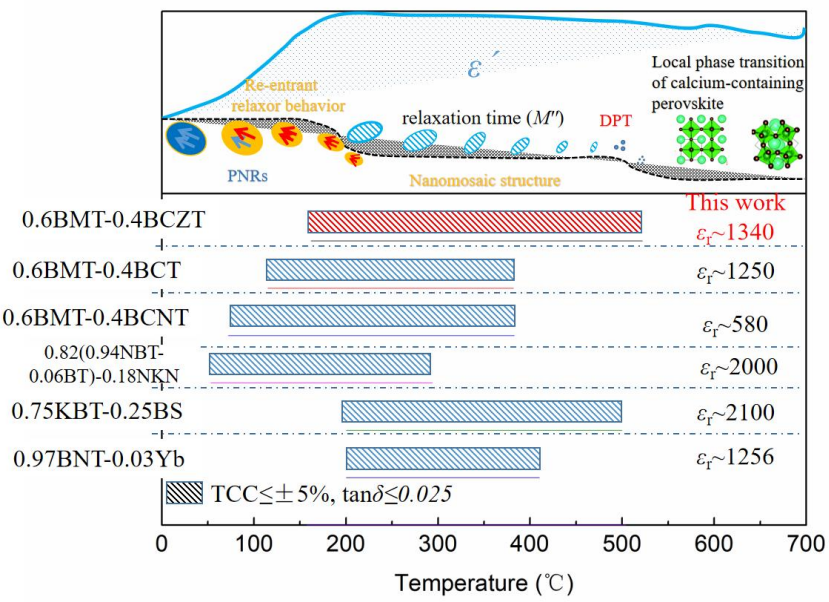

Fig. S1

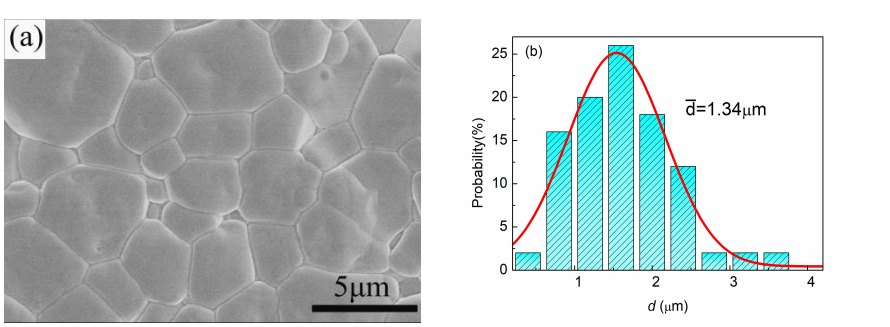

Fig. S2

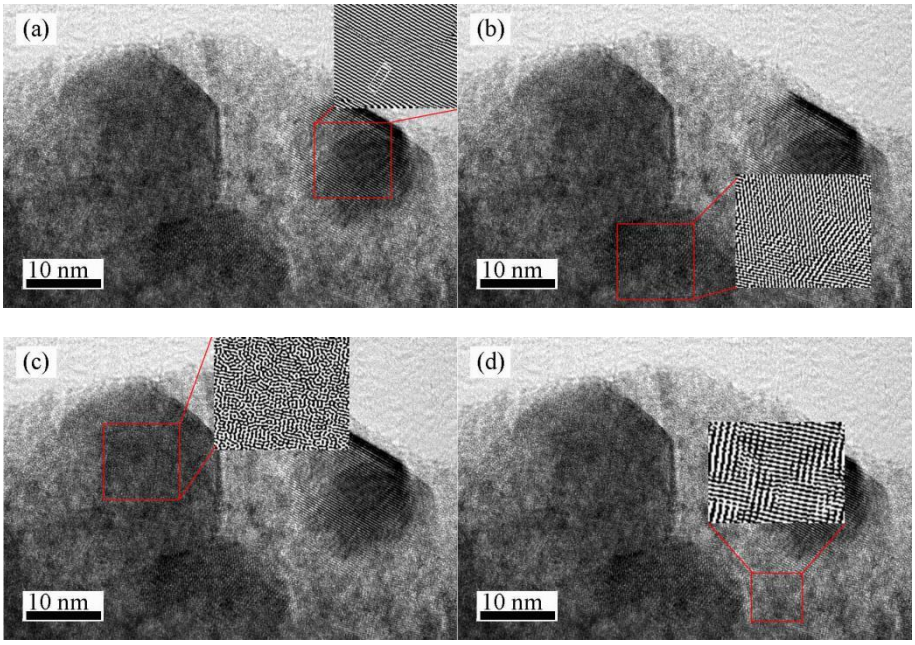

Fig. S3

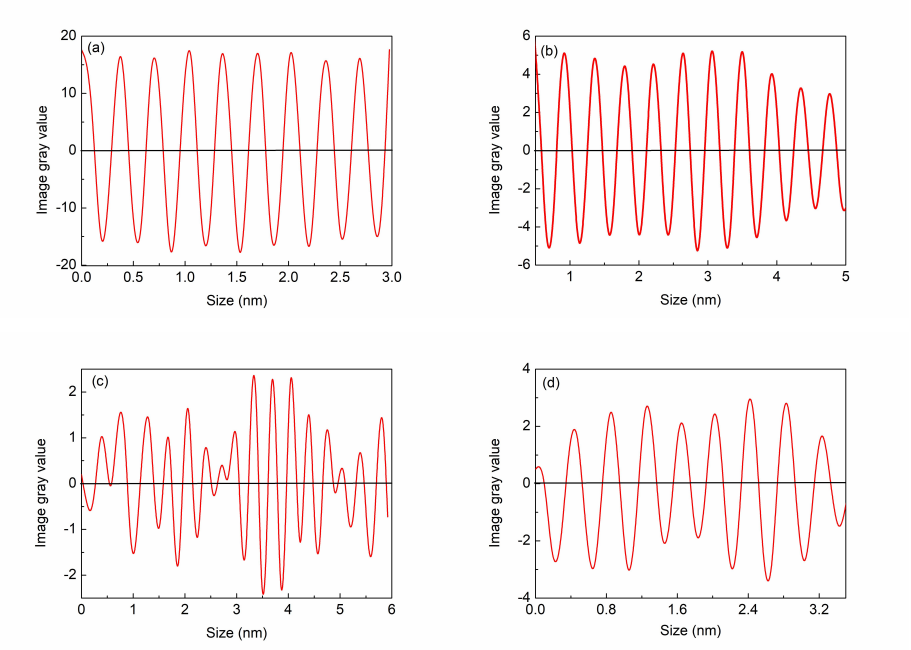
(a)
Image gray value
Size (nm)
(b)
Image gray value
Size (nm)
(c)
Image gray value
Size (nm)
(d)
Image gray value
Size (nm)

Fig. S4

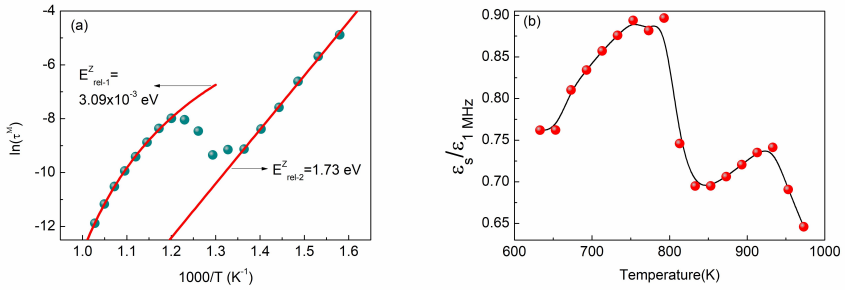
(a)
E^{Z}_{rel-1} =
3.09x10^{-3} eV
E^{Z}_{rel-2}=1.73 eV
ln(τ^{-M})
1000/T (K^{-1})
(b)
$\varepsilon_s/\varepsilon_{1\ MHz}$
Temperature(K)

Fig. S5

References

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