Supplementary Information

for

Strain evolution from ferroelectric to relaxor state in (0.67-*x*)$BiFeO_3$-0.33$BaTiO_3$-*x*$Bi(Mg_{0.5}Zr_{0.5})O_3$ lead free ceramics

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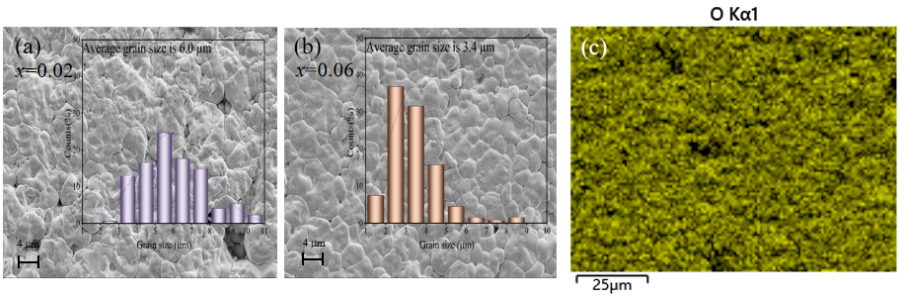

Figure S1. SEM images and grain size distributions of BF-BT-*x*BMZ ceramics: (a) x = 0.02; (b) x = 0.06; (c) Element mapping of 0.63BF-0.33BT-0.04BMZ ceramic.

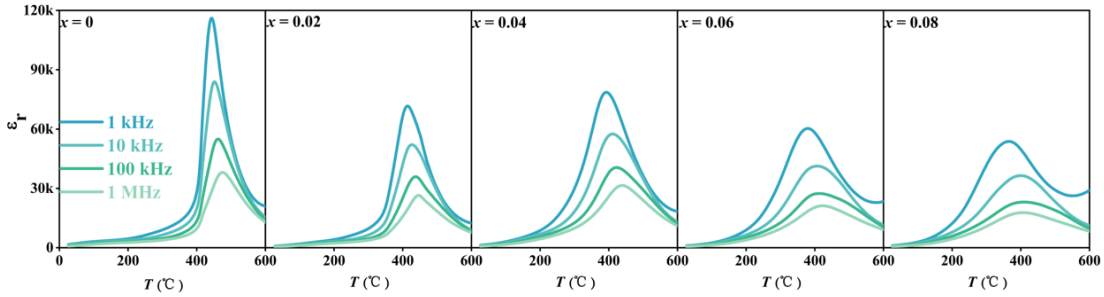

Figure S2. the ε_r-T curves of each component measured at 25-600 °C.

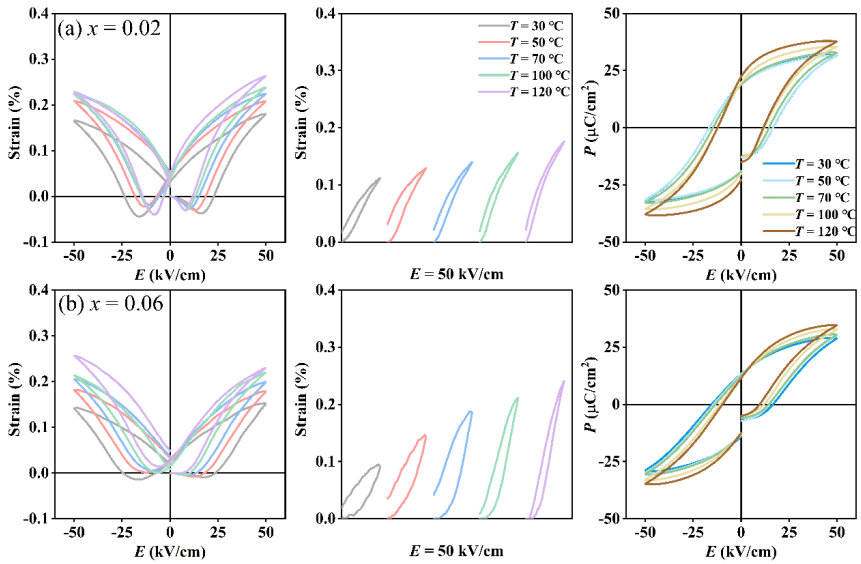

Figure S3. bipolar and unipolar strain curves and *P*-*E* loops at different temperature (a) x = 0.02; (b) x = 0.06.

Table S1. Piezoelectric property of piezoelectric ceramics.

Materials	d_{33} (pC/N)	Reference
PNN-PZT-*x*LN	~1178 pC/N	[1]
BF-BT-*x*BA	~283 pC/N	[2]
BF(MN)(*x*)-BT-BNT	~240 pC/N	[3]
0.75BF-0.25BZT	~138 pC/N	[4]
0.34BF-0.33BT-0.33BG	~402 pC/N	[5]
BF-BT	~170 pC/N	This work
BF-BT-0.04BMZ	~35 pC/N	This work
BF-BT-0.08BMZ	~10 pC/N	This work

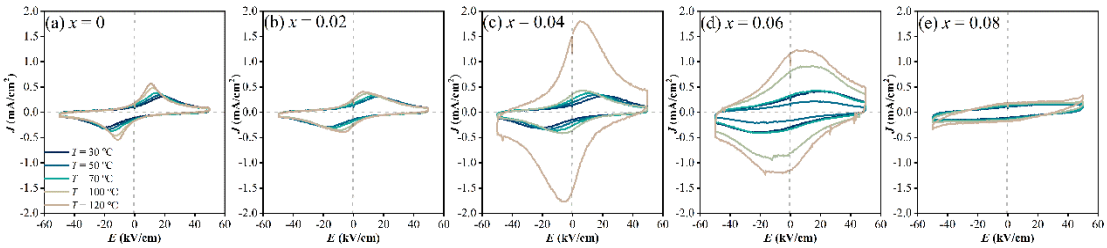

Figure S4. The J-E loops of BF-BT-*x*BMZ at different temperature.

Table S2. Leakage current density of BF-BT based material systems.

Materials	J (mA/cm^2)	Temperature (°C)	Reference
0.75BF-0.25BT	~0.4-2.1 mA/cm^2	20-100 °C	[6]
0.65BF-0.35BT	~0.9-2.6 mA/cm^2	20-100 °C	[6]
0.55BF-0.45BT	~0.9-1.1 mA/cm^2	20-100 °C	[6]
$Bi_{0.8}(Sr_{0.5}Ca_{0.5})_{0.2}Fe_{0.8}Ti_{0.2}O_3$	~1.5 mA/cm^2	Room-tem	[7]
$Bi_{0.6}(Sr_{0.5}Ca_{0.5})_{0.4}Fe_{0.6}Ti_{0.4}O_3$	~0.9 mA/cm^2	Room-tem	[7]
0.73BF-0.27BTGT	~1.2 mA/cm^2	Room-tem	[8]
0.67BF-0.33BT	~0.2-0.6 mA/cm^2	30-120 °C	This work

BF-BT-0.04BMZ	~0.3-1.7 mA/cm^2	30-120 ℃	This work
BF-BT-0.08BMZ	~0.1-0.3 mA/cm^2	30-120 ℃	This work

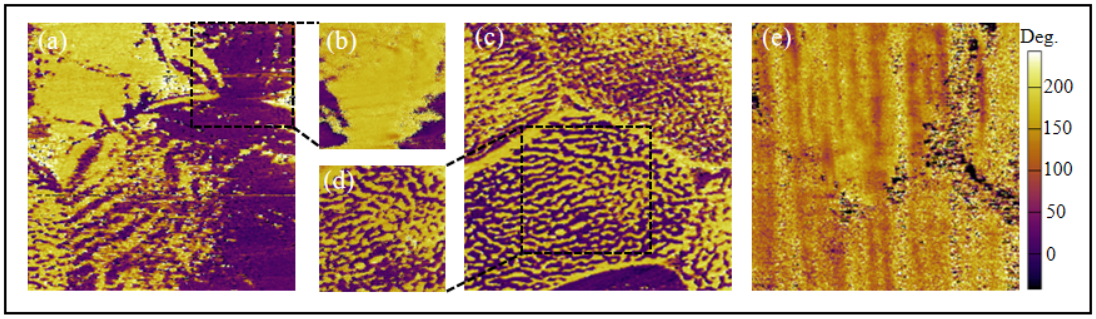

Figure S5. Phase images of ceramics (a) and (b) x = 0; (c) and (d) x = 0.04; (e) x =0.08.

REFERENCE

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