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Decoding the domain dynamics of polycrystalline $0.7BiFeO_3$-$0.3BaTiO_3$

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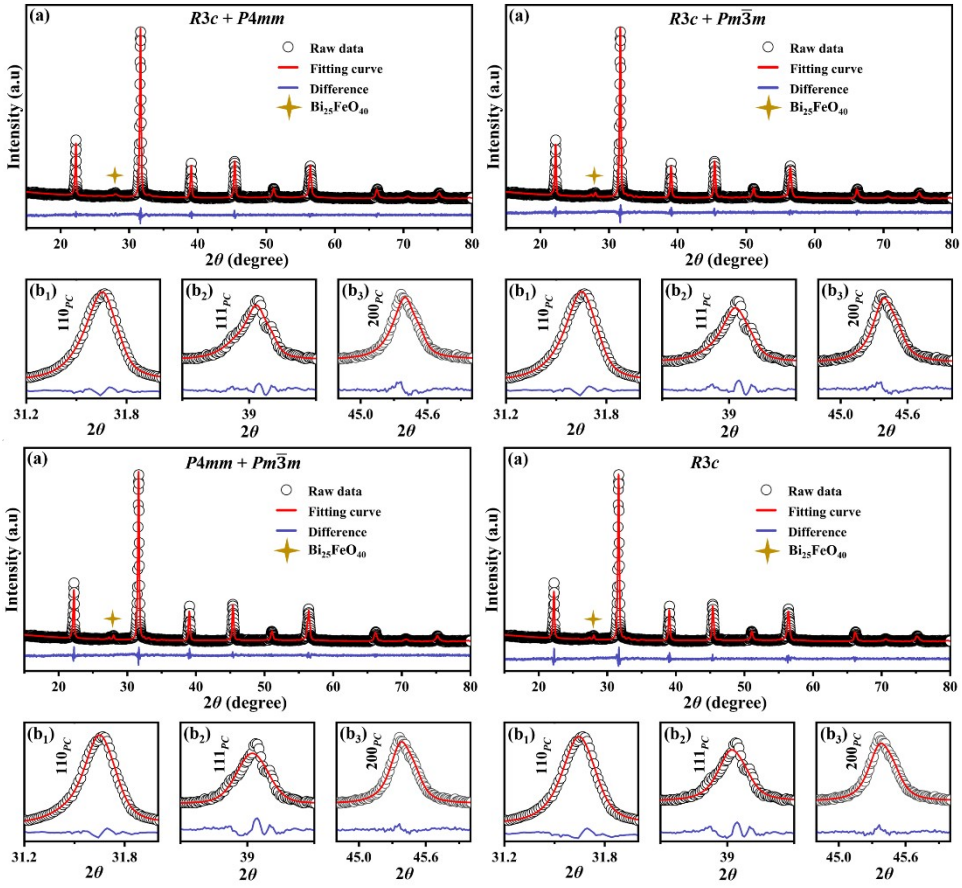

Figure S1. Rietveld refinement XRD patterns of BF30BT with different models.

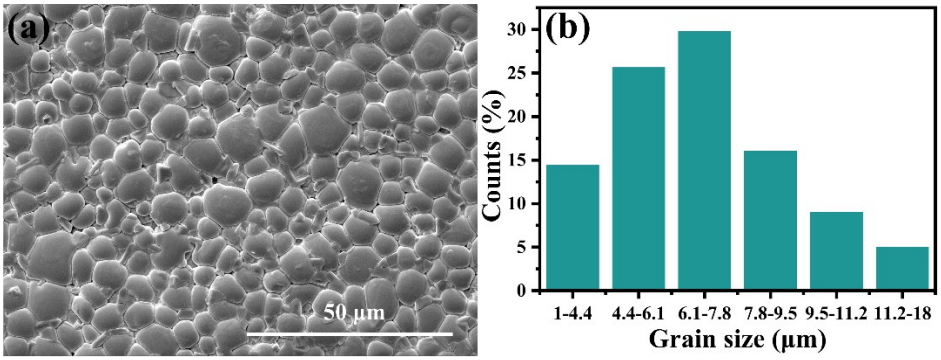

Figure S2. (a) Surface SEM microstructure images of BF30BT and (b) statistics of grain size.

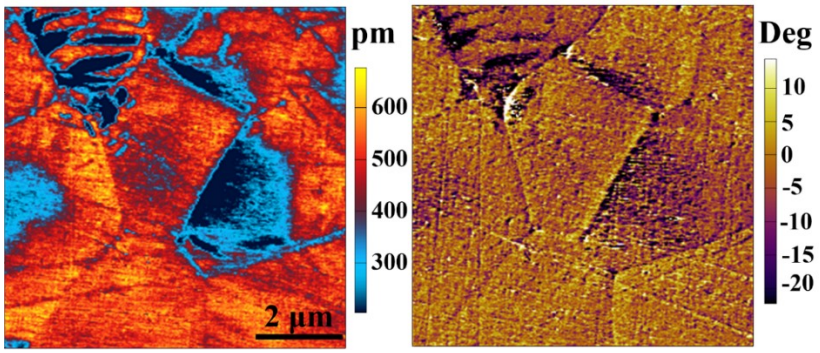

Figure S3. The amplitude and corresponding phase pattern of poled BF30BT ceramic.

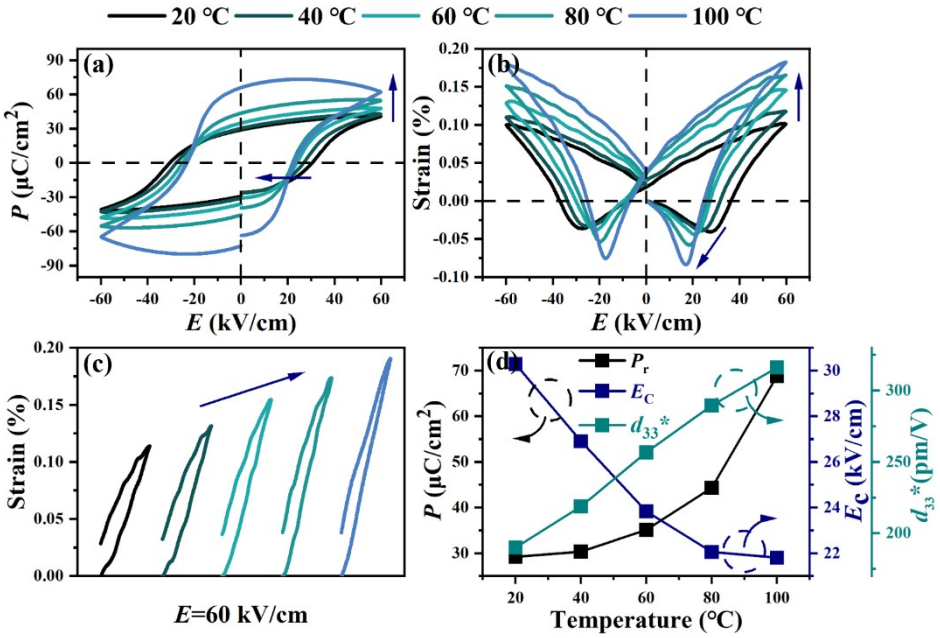

Figure S4. (a) variation of *P*-*E* hysteresis loops as a function of temperature in BF30BT (b) bipolar curves of the BF30BT ceramic as a function of temperature; (c) unipolar curves of the BF30BT ceramic as a function of temperature; (d) variation of P_r, E_c, and d_{33}* as a function of temperature.

The frequency dependence of the piezoelectric response d_{33} at 25 °C is plotted in Figure S4, and its linear relationship is revealed through frequency-dependence Rayleigh analysis.

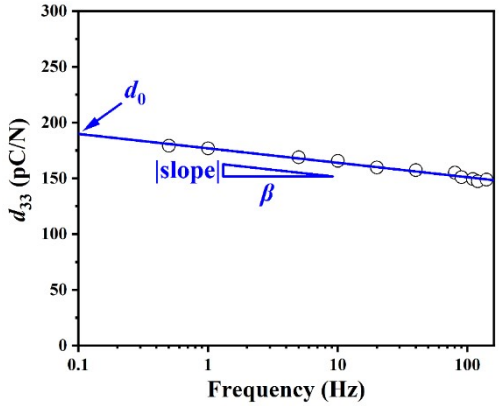

Figure S5. Linear relationship between d_{33} and frequency at 20 °C.

The amplitude dependence of the piezoelectric response d_{33} at 250 ℃ is plotted in Figure S5, and its linear relationship is revealed through amplitude-dependence Rayleigh analysis.

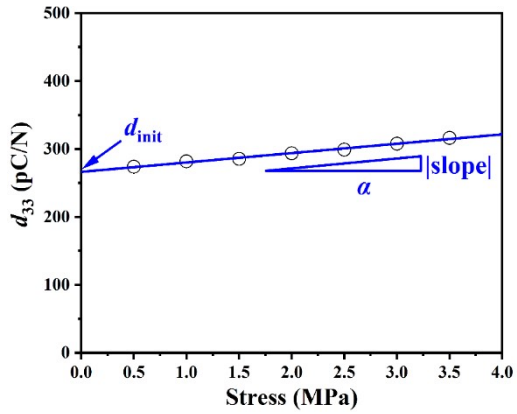

Figure S6. Linear relationship between d_{33} and stress σ_A at 250 °C.

Table S1. Crystal structure parameters of the BF30BT ceramic derived from the Rietveld structure refinement program with different models

Model	Sig	R_{wp} (%)	Symmetry	Space group	Phase ratio	*a* (Å)	*c* (Å)	*α* (°)
*R*3*c* + *P*4*mm*	1.31	4.10	R phase	*R*3*c*	63.27%	5.6439	13.8192	
			T phase	*P*4*mm*	31.70%	3.9962	4.0189	
			$Bi_{25}FeO_{40}$	*I*23	5.03%			
*R*3*c* + $Pm\bar{3}m$	1.38	4.31	R phase	*R*3*c*	62.01%	5.6461	13.8229	
			PC phase	$Pm\bar{3}m$	34.50%	4.0010		
			$Bi_{25}FeO_{40}$	*I*23	3.49%			
*R*3*c*	1.54	4.8	R phase	*R*3*c*	95.67%	5.6480	13.8301	
			$Bi_{25}FeO_{40}$	*I*23	4.33%			
			T phase	*P*4*mm*	29.48%	3.9928	4.0497	

			PC phase	$Pm\bar{3}m$	4.97%	3.9927		
			$Bi_{25}FeO_{40}$	$I23$	3.17%			

Table S2. Crystal structure parameters of the unpoled BF30BT ceramics derived from the Rietveld structure refinement program with different temperature

Temperature	Sig	R_{wp} (%)	Symmetry	Space group	Phase ratio	*a* (Å)	*c* (Å)	*α* (°)
25 ℃	1.32	6.41	R phase	*R*3*c*	62.14%	5.6282	13.7914	
			T phase	*P*4*mm*	33.51%	3.9842	4.0052	
			$Bi_{25}FeO_{40}$	*I*23	4.35%			
	1.59	7.34	R phase	*R*3*m*	60.17%	3.9727		89.8736
			T phase	*P*4*mm*	34.71%	3.9861	4.0067	
			$Bi_{25}FeO_{40}$	*I*23	5.15%			
50 ℃	1.35	6.72	R phase	*R*3*c*	60.29%	5.6314	13.8027	
			T phase	*P*4*mm*	35.20%	3.9867	4.0063	
			$Bi_{25}FeO_{40}$	*I*23	4.51%			
	1.57	7.21	R phase	*R*3*m*	58.29%	3.9734		89.8862
			T phase	*P*4*mm*	37.10%	3.9869	4.0072	
			$Bi_{25}FeO_{40}$	*I*23	4.61%			
75 ℃	1.37	6.79	R phase	*R*3*c*	58.43%	5.6340	13.8123	
			T phase	*P*4*mm*	37.34%	3.9899	4.0092	
			$Bi_{25}FeO_{40}$	*I*23	4.23%			
	1.54	7.38	R phase	*R*3*m*	57.42%	3.9760		89.8911
			T phase	*P*4*mm*	38.45%	3.9884	4.0084	
			$Bi_{25}FeO_{40}$	*I*23	4.13%			
			R phase	*R*3*c*	56.11%	5.6365	13.8211	

			T phase	*P*4*mm*	38.92%	3.9922	4.0104	
			$Bi_{25}FeO_{40}$	*I*23	4.97%			
	1.49	7.09	R phase	*R*3*m*	55.72%	3.9809		89.9021
			T phase	*P*4*mm*	39.71%	3.9909	4.0105	
			$Bi_{25}FeO_{40}$	*I*23	4.57%			
150 ℃	1.44	6.83	R phase	*R*3*c*	54.37%	5.6393	13.8244	
			T phase	*P*4*mm*	40.61%	3.9948	4.0122	
			$Bi_{25}FeO_{40}$	*I*23	5.02%			
	1.46	7.17	R phase	*R*3*m*	53.91%	3.9839		89.9163
			T phase	*P*4*mm*	41.83%	3.9919	4.0113	
			$Bi_{25}FeO_{40}$	*I*23	4.26%			
200 ℃	1.46	6.92	R phase	*R*3*c*	52.76%	5.6411	13.8337	
			T phase	*P*4*mm*	42.79%	3.9957	4.0135	
			$Bi_{25}FeO_{40}$	*I*23	4.45%			
	1.44	6.98	R phase	*R*3*m*	52.98%	3.9861		89.9356
			T phase	*P*4*mm*	41.82%	3.9943	4.0121	
			$Bi_{25}FeO_{40}$	*I*23	5.20%			
300 ℃	1.48	7.01	R phase	*R*3*c*	50.91%	5.6421	13.8410	
			T phase	*P*4*mm*	44.23%	3.9972	4.0148	
			$Bi_{25}FeO_{40}$	*I*23	4.86%			
	1.43	6.92	R phase	*R*3*m*	51.85%	3.9921		89.9463
			T phase	*P*4*mm*	43.78%	3.9969	4.0131	

			$Bi_{25}FeO_{40}$	*I*23	4.37%			
400 ℃	1.49	7.11	R phase	*R*3*c*	49.98%	5.6481	13.8635	
			T phase	*P*4*mm*	45.83%	4.0012	4.0153	
			$Bi_{25}FeO_{40}$	*I*23	4.19%			
	1.41	6.83	R phase	*R*3*m*	50.26%	3.9961		89.9653
			T phase	*P*4*mm*	45.18%	4.0018	4.0157	
			$Bi_{25}FeO_{40}$	*I*23	4.56%			
450 ℃	1.51	7.19	R phase	*R*3*c*	47.96%	5.6504	13.8667	
			T phase	*P*4*mm*	43.94%	4.0047	4.0176	
			$Bi_{25}FeO_{40}$	*I*23	4.81%			
	1.44	7.01	R phase	*R*3*m*	48.72%	3.9986		89.9811
			T phase	*P*4*mm*	46.69%	4.0048	4.0174	
			$Bi_{25}FeO_{40}$	*I*23	4.59%			
	1.36	6.58	R phase	*R*3*m*	37.28%	3.9995		89.9847
			C phase	$Pm\bar{3}m$	57.60%	4.0046		
			$Bi_{25}FeO_{40}$	*I*23	5.12%			

Table S3. Crystal structure parameters of the poled BF30BT ceramics derived from the Rietveld structure refinement program with different temperature

Temperature	Sig	R_{wp} (%)	Symmetry	Space group	Phase ratio	*a* (Å)	*c* (Å)	*α* (°)
25 ℃	1.21	5.87	R phase	*R*3*c*	72.23%	5.6299	13.7974	
			T phase	*P*4*mm*	22.64%	3.9861	4.0105	
			$Bi_{25}FeO_{40}$	*I*23	5.13%			
	1.49	7.13	R phase	*R*3*m*	70.38%	3.9767		89.8635
			T phase	*P*4*mm*	24.77%	3.9856	4.0149	
			$Bi_{25}FeO_{40}$	*I*23	4.84%			
50 ℃	1.26	6.01	R phase	*R*3*c*	70.86%	5.6305	13.8036	
			T phase	*P*4*mm*	36.87%	3.9868	4.0108	
			$Bi_{25}FeO_{40}$	*I*23	4.41%			
	1.47	6.93	R phase	*R*3*m*	69.94%	3.9734		89.8832
			T phase	*P*4*mm*	25.87%	3.9878	4.0168	
			$Bi_{25}FeO_{40}$	*I*23	4.19%			
75 ℃	1.27	6.13	R phase	*R*3*c*	68.97%	5.6314	13.8065	
			T phase	*P*4*mm*	25.81%	3.9874	4.0108	
			$Bi_{25}FeO_{40}$	*I*23	5.22%			
	1.47	6.81	R phase	*R*3*m*	67.81%	3.9843		89.8903
			T phase	*P*4*mm*	27.04%	3.9885	4.0172	
			$Bi_{25}FeO_{40}$	*I*23	5.15%			
			R phase	*R*3*c*	67.01%	5.6319	13.8077	

			T phase	*P*4*mm*	27.73%	3.9881	4.0113	
			$Bi_{25}FeO_{40}$	*I*23	5.26%			
	1.45	6.77	R phase	*R*3*m*	65.72%	3.9851		89.9061
			T phase	*P*4*mm*	28.49%	3.9889	4.0175	
			$Bi_{25}FeO_{40}$	*I*23	5.79%			
150 ℃	1.36	6.54	R phase	*R*3*c*	66.07%	5.6330	13.8105	
			T phase	*P*4*mm*	30.76%	3.9896	4.0125	
			$Bi_{25}FeO_{40}$	*I*23	3.17%			
	1.42	6.68	R phase	*R*3*m*	63.89%	3.9856		89.9124
			T phase	*P*4*mm*	32.28%	3.9896	4.0181	
			$Bi_{25}FeO_{40}$	*I*23	3.83%			
200 ℃	1.37	6.59	R phase	*R*3*c*	63.91%	5.6341	13.8150	
			T phase	*P*4*mm*	35.11%	3.9916	4.0133	
			$Bi_{25}FeO_{40}$	*I*23	4.98%			
	1.36	6.49	R phase	*R*3*m*	61.71%	3.9871		89.9241
			T phase	*P*4*mm*	32.88%	3.9921	4.0201	
			$Bi_{25}FeO_{40}$	*I*23	5.41%			
300 ℃	1.40	6.72	R phase	*R*3*c*	61.39%	5.6436	13.8389	
			T phase	*P*4*mm*	33.74%	3.9938	4.0151	
			$Bi_{25}FeO_{40}$	*I*23	4.87%			
	1.35	6.71	R phase	*R*3*m*	59.99%	3.9919		89.9301
			T phase	*P*4*mm*	35.00%	3.9934	4.0213	

			$Bi_{25}FeO_{40}$	*I*23	5.01%			
400 ℃	1.43	6.81	R phase	*R*3*c*	59.01%	5.6468	13.8592	
			T phase	*P*4*mm*	36.26%	3.9989	4.0179	
			$Bi_{25}FeO_{40}$	*I*23	4.73%			
	1.35	6.67	R phase	*R*3*m*	56.81%	3.9944		89.9518
			T phase	*P*4*mm*	38.26%	4.0018	4.0223	
			$Bi_{25}FeO_{40}$	*I*23	4.93%			
450 ℃	1.43	7.01	R phase	*R*3*c*	54.29%	5.6512	13.8629	
			T phase	*P*4*mm*	40.99%	4.0042	4.0183	
			$Bi_{25}FeO_{40}$	*I*23	4.72%			
	1.36	6.70	R phase	*R*3*m*	51.39%	3.9978		89.9774
			T phase	*P*4*mm*	42.80%	4.0053	4.0245	
			$Bi_{25}FeO_{40}$	*I*23	5.81%			
	1.31	6.59	R phase	*R*3*m*	43.70%	3.9976		89.9501
			C phase	$Pm\bar{3}m$	51.18%	4.0050		
			$Bi_{25}FeO_{40}$	*I*23	5.12%			

Table S4. Electrical properties of BF30BT ceramic at room temperature

d_{33}	k_p	Q_m	*tan δ*	P_r	E_c

165 pC/N	0.32	50	0.02	29.2 μC/cm^2	30.3 kV/cm