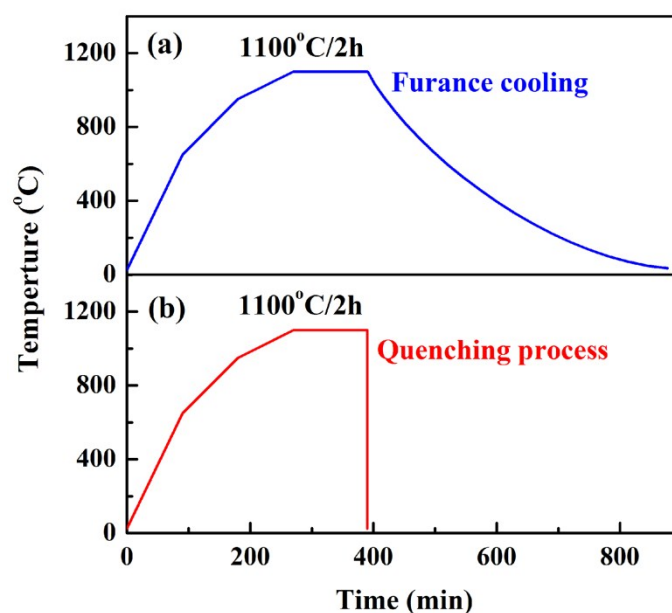


## Supplementary Material

### Enhanced piezoelectric property in quenched BiFeO<sub>3</sub>-based piezoceramics: role of defects and mesophase

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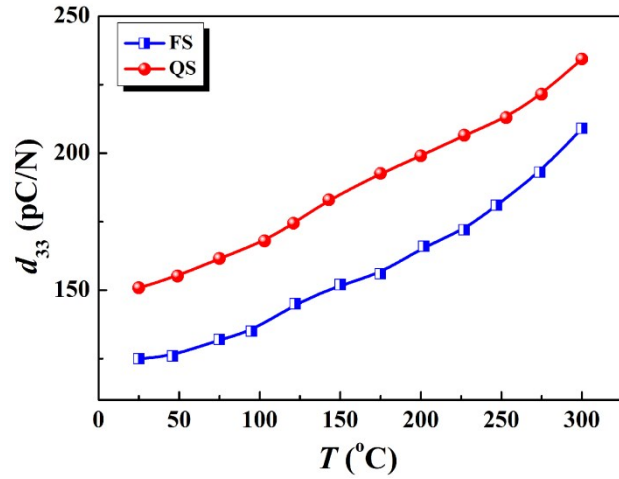
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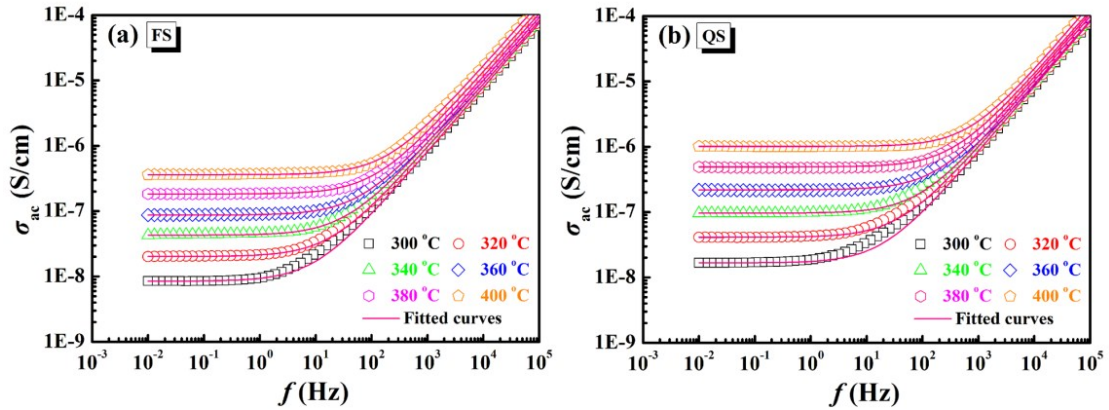
**Fig. S1** Sintering schedule of different heat treatments: (a) the normal sintered schedule, samples were sintered at 1100 °C for 2 h, and then cooled down with the furnace; (b) the quenching process schedule, samples were sintered at 1100 °C for 2 h, and then removed out of the furnace after sintering process and rapidly cooled down in the air.

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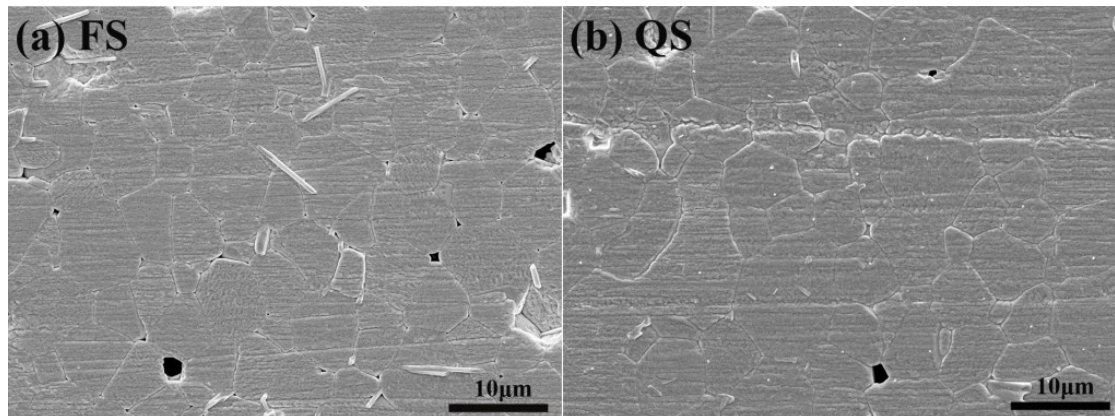
\* Corresponding author. E-mail: [ydhoul@bjut.edu.cn](mailto:ydhoul@bjut.edu.cn)



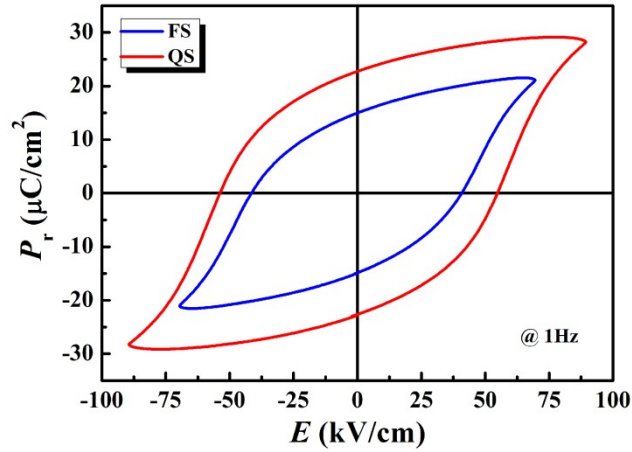
**Fig. S2** *In-situ* measurement of the  $d_{33}$  as a function of temperature for FS and QS samples.



**Fig. S3** Frequency dependence of AC conductivity for (a) FS sample selected according to Ref.<sup>1</sup> and (b) QS ceramic at different temperature points between 300 °C and 400 °C.



**Fig. S4** The SEM micrographs of (a) FS and (b) QS samples.



**Fig. S5**  $P$ - $E$  hysteresis loops of FS and QS samples, measured at 1 Hz.

**Table S1** Rietveld refinement parameters of FS and QS ceramics.

Samples	Space group	Lattice parameters			Phase fraction (%)	Refined factors		
		a (Å)	b (Å)	c (Å)		$R_{wp}$ (%)	$R_p$ (%)	$\chi^2$
FS	$P4mm$	3.9621	3.9621	4.1169	89.90	5.62	4.00	2.80
	$R3mr$	4.0310	4.0310	4.0310	10.10			
QS	$P4mm$	3.9606	3.9606	4.1193	87.61	4.28	2.82	3.70
	$R3mr$	4.0269	4.0269	4.0269	11.94			
	$FeBi_5Ti_3O_{15}$	5.4665	5.4335	41.0241	0.45			

## References

1. H. Zhao, Y. Hou, X. Yu, M. Zheng and M. Zhu, *J. Appl. Phys.*, 2018, **124**, 194103.