

Supporting Information

High energy storage density with high power density in $\text{Bi}_{0.2}\text{Sr}_{0.7}\text{TiO}_3/\text{BiFeO}_3$

multilayer thin films

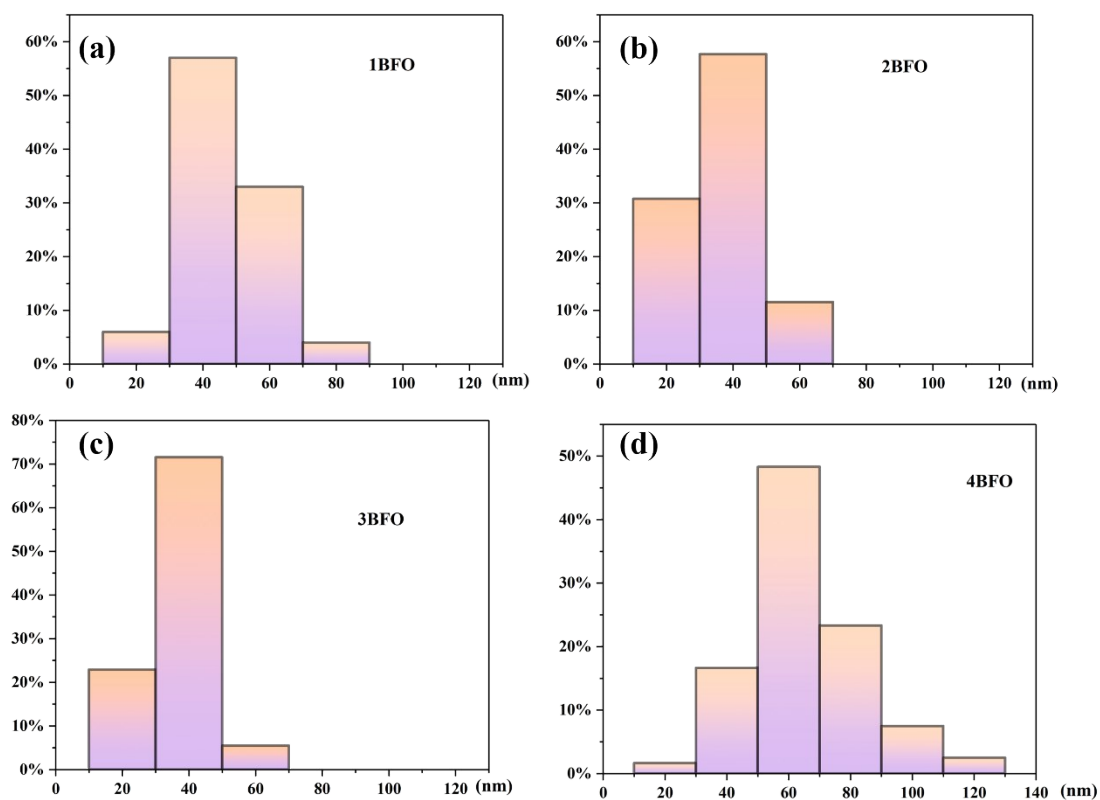
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1 Power density can be calculated as following equation: $p_D = \frac{U_{rec}}{2ESRC}$, where ESR
 2 means equivalent series resistance, expressed as: $ESR = \tan\delta \times X_c = \frac{\tan\delta}{2\pi fC}$. Based on
 3 above equations, calculated power density of 2BFO reaches up to 2.28 MW cm⁻³ at 1
 4 kHz. Note that calculated p_D is greatly difference from measured p_D . It is so strange.
 5 But p_D of the same order of magnitude~ 6.47 MW cm⁻³ is also obtained in
 6 BaSn_{0.15}Ti_{0.85}O₃/Ba_{0.6}Sr_{0.4}TiO₃ thin film with U_{rec} ~43.28 J cm⁻³, $\tan\delta$ ~0.02 and f ~1 kHz
 7 based on above equations¹. In addition, 0.94(Bi_{0.5}Na_{0.5})_{0.94}TiO₃-0.06BaTiO₃/BiFeO₃
 8 multilayer thin film also possesses power density of 47 MW cm⁻³ measured by a RLC
 9 circuit while calculated value of that is only near to 2.01 MW cm⁻³ with U_{rec} ~31.96 J
 10 cm⁻³, $\tan\delta$ ~0.05 and f ~1 kHz². As far as we know, U_{rec} is obtained via P - E loops under
 11 AC while measured p_D is based on current magnitude under DC. The electrode area of
 12 P - E and charge/discharge measurement is 0.3 mm and 2 mm. Voltage source type and
 13 electrode area may lead to the divergence.
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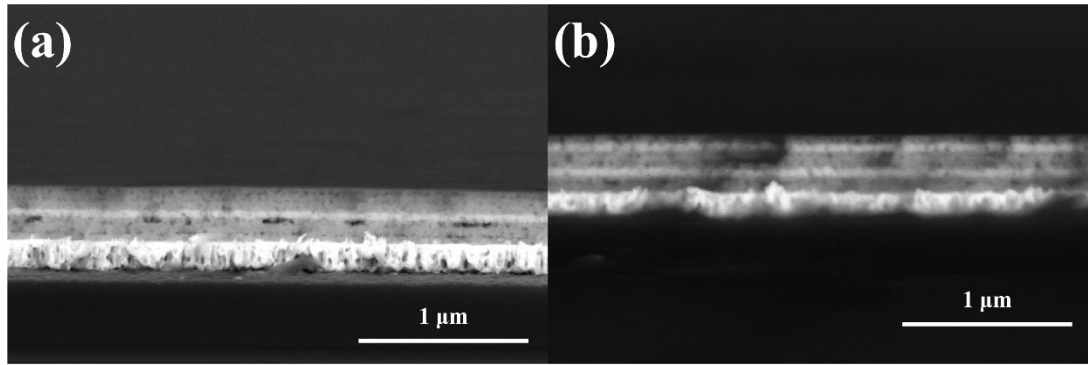


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3 **Figure. S1.** Particle size distribution of (a) 1BFO, (b) 2 BFO, (c) 3 BFO and (d) 4BFO

4 thin film.

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2 **Figure. S2.** The cross-sectional micrograph of (a) 1BFO and (b) 2BFO thin film.

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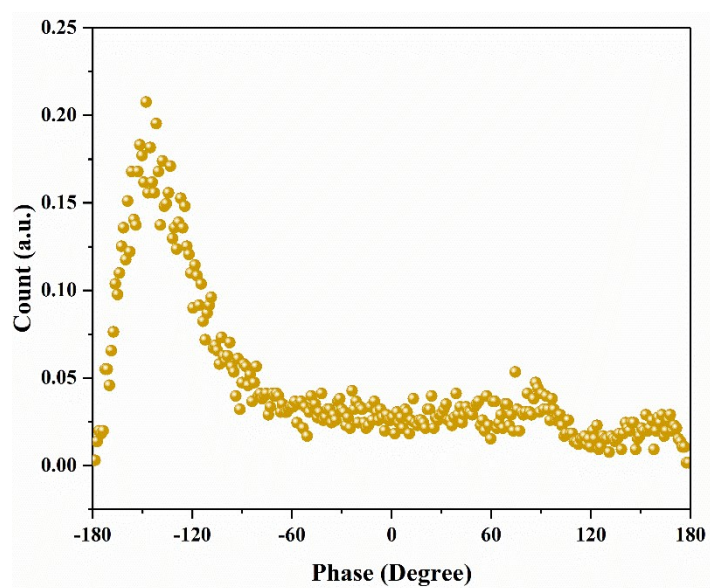


Figure. S3. PFM phase plot of 1BFO thin film.

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Table. S1. The roughness of *x*BFO thin films.

| BFO layer | Rq (nm) | Ra (nm) |
|------------------|----------------|----------------|
| 1 | 0.841 | 0.683 |
| 2 | 1.120 | 0.861 |
| 3 | 1.260 | 0.907 |
| 4 | 2.010 | 1.630 |

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1 S. Yu, C. Zhang, M. Wu, H. Dong and L. Li, *Journal of Power Sources*, 2019, **412**, 648-654.
2 P. Chen, S. Wu, P. Li, J. Zhai and B. Shen, *Inorganic Chemistry Frontiers*, 2018, **5**, 2300-
2305.