

## Supplementary Information

### Thermal Expansion of Nano-sized BaTiO<sub>3</sub>

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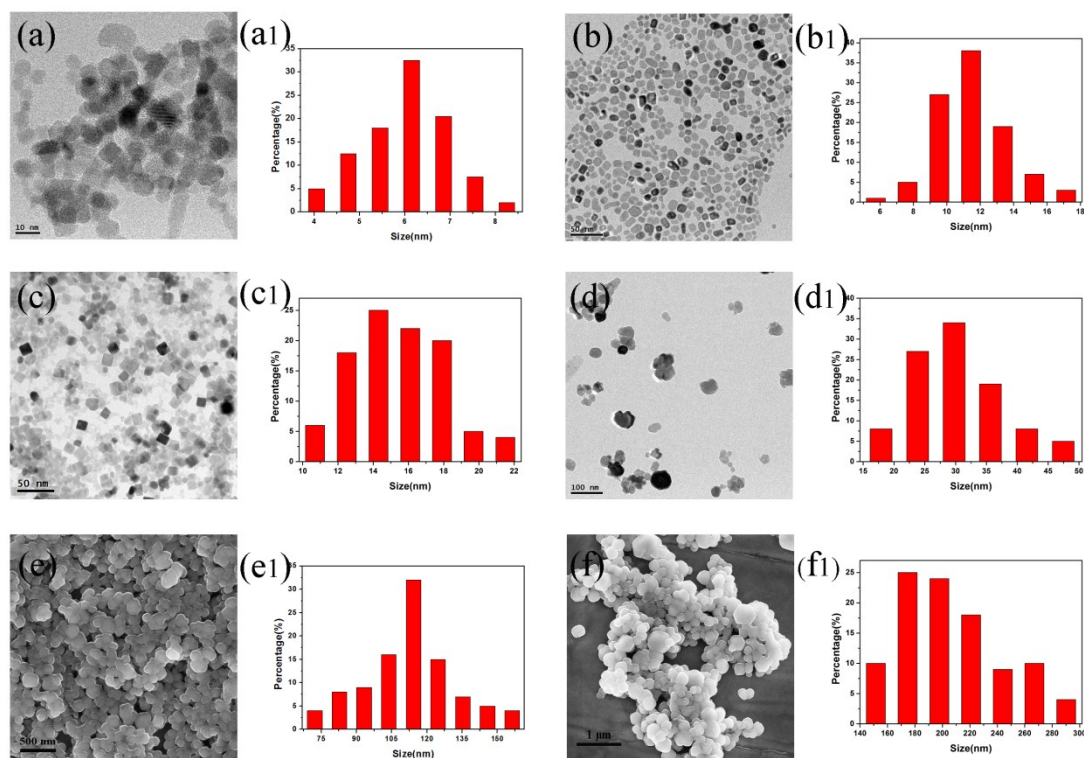
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## Contents

1	Size distributions of typic BTO samples.....	S2
2	Detailed experimental conditions and relevant results.....	S3-S4
3	SEM or TEM images of samples before and after high-temperature XRD..	S5-S6

# 1 Size distribution of typical samples

The size distribution of different size 6 to 210 nm samples are showed in Fig S1. It can be clearly found that all the samples had a narrow size distribution.



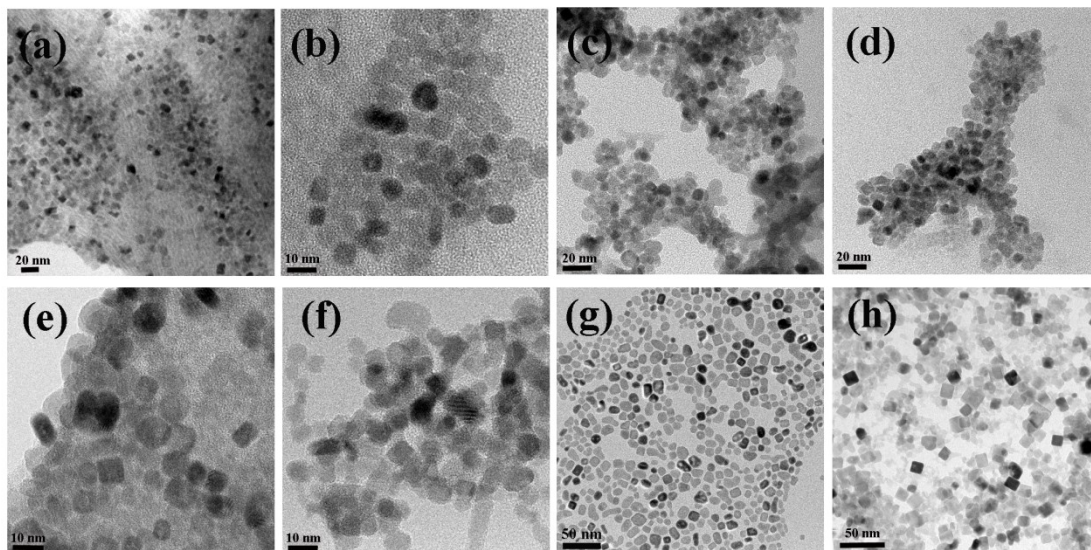
**Figure S1.** Size distribution of different samples with the size of (a)  $6.2 \pm 1.2$  nm, (b)  $11.4 \pm 2.2$  nm, (c)  $15.5 \pm 2.7$  nm, (d)  $29 \pm 4.7$  nm (e)  $101.3 \pm 12.3$  nm, (f)  $207 \text{ nm} \pm 39.3$  nm.

## 2 Detailed experimental conditions and relevant results

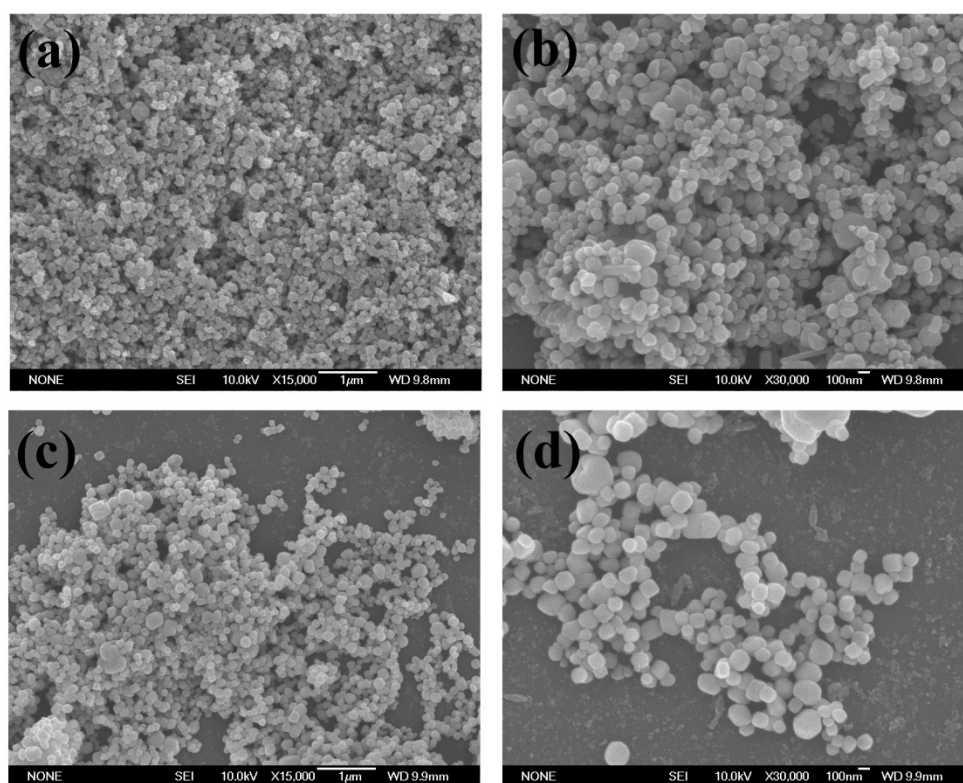
**Table S1.** Detail experimental conditions and results for synthesis of BaTiO<sub>3</sub>.

Capping agent	Reaction temperature (°C)	Reaction time (h)	Precursor concentration (mM)	Size of sample (nm)
Oleic acid	140	6	0.5	×
	140	12	0.5	×
	140	24	0.5	×
	140	48	0.5	8
	160	6	0.5	×
	160	12	0.5	9
	160	24	0.5	9
	160	48	0.5	9
	180	6	0.5	9
	180	12	0.5	9
	180	24	0.5	9
	180	48	0.5	11
	180	12	0.25	6
	180	12	1.0	15
	PEG20000	180	3	0.25
180		6	0.25	70
180		12	0.25	90
180		24	0.25	100
180		48	0.25	210

× means that BaTiO<sub>3</sub> did not be synthesized.



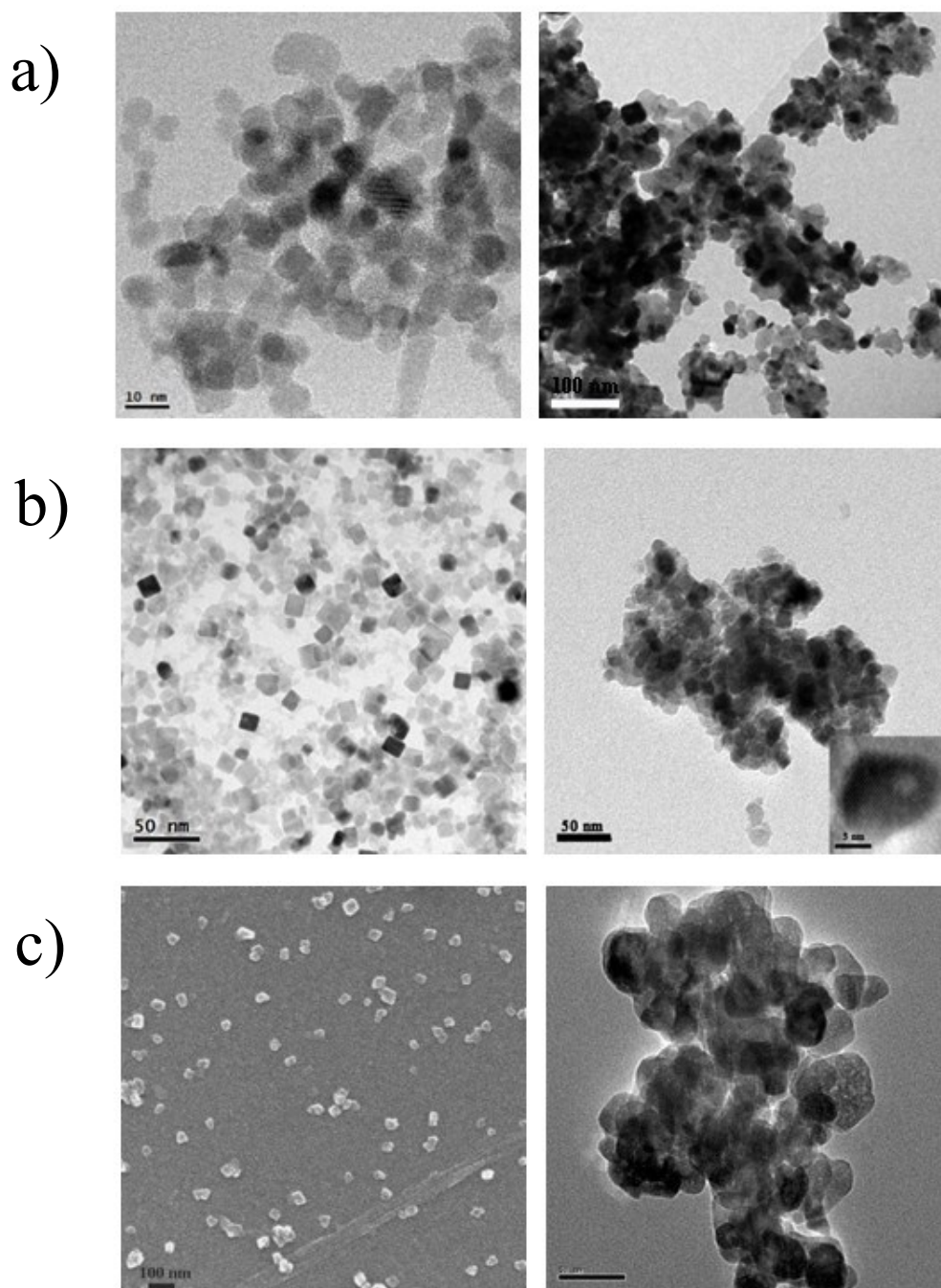
**Figure S2.** Samples of BTiO<sub>2</sub> at different experiment conditions (oleic acid as coating agent). (a) 8 nm (140°C, 0.5M, 48h), (b) 9 nm (160°C, 0.5M, 48h), (c) 11 nm (180°C, 0.5M, 48h), (d) 9 nm (180°C, 0.5M, 12h), (e) 9 nm (180°C, 0.5M, 24h), (f) 6 nm (180°C, 0.25M, ), (g) 11 nm (180°C, 0.5M, 12h), (h) 15 nm (180°C, 1.0M, 12h).



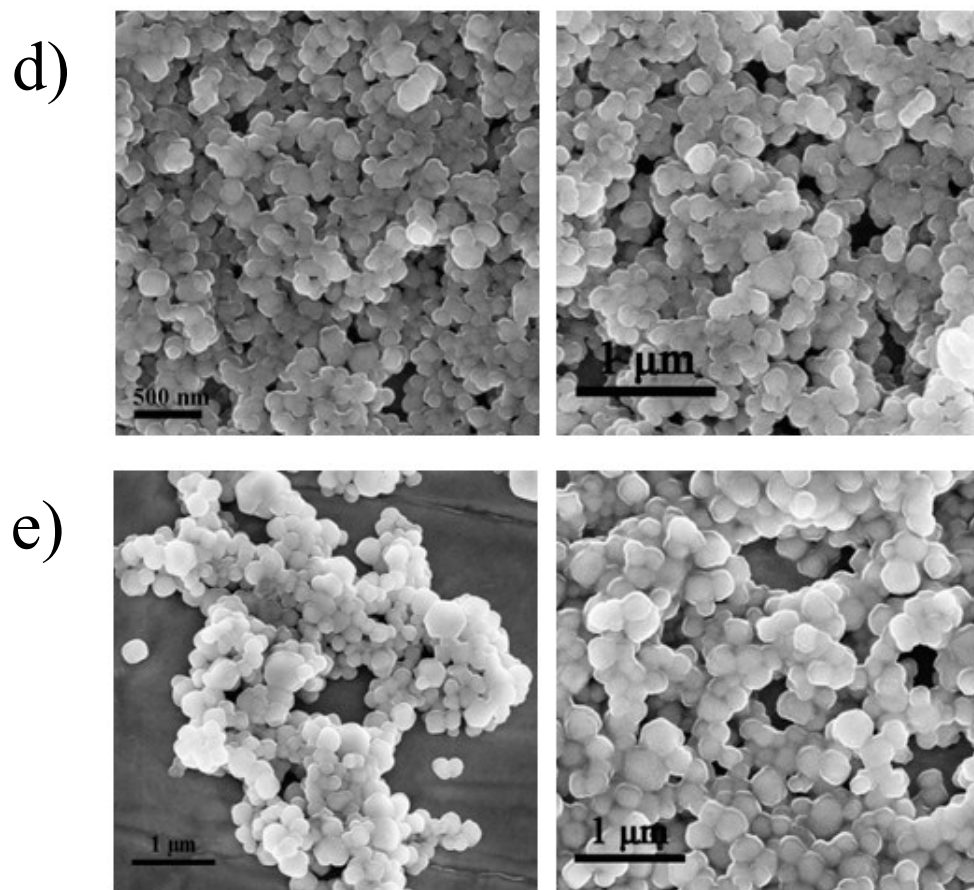
**Figure S3.** Samples of BTiO<sub>2</sub> at different experiment conditions (PEG20000 as coating agent) with (a) 70 nm (180°C, 0.25M, 6h), (b) 90 nm (180°C, 0.25M, 12h), (c) 100 nm (180°C, 0.25M, 24h), (d) 210 nm (180°C, 0.25M, 48h).

### 3 SEM or TEM images of BTO samples before and after the measurement of high-temperature XRD

The TEM or SEM images of samples before/after the measurement of high temperature XRD are showed in Fig. S4. In Fig. S4a, it can be clearly found that 6-nm BTO had a serious agglomeration and samples significantly grew up to about 30 nm after heating. The images of 15- to 210-nm BTO reveal that there is not obvious size change except slight aggregation.







**Figure S4.** SEM and TEM images of samples before (left) and after (right) high temperature XRD treatment with for different samples with the average size of (a) 6 nm, (b) 15 nm, (c) 30 nm, (c) 100 nm and (e) 210 nm.