Supplementary Information:

# Solvothermal synthesis and enhanced photo-electrochemical performance of hierarchically structured strontium titanate micro-particles

Tao Zhang,[a] Thomas Doert*[a] and Michael Ruck[ab]

[a] *Department of Chemistry and Food Chemistry, Technische Universität Dresden, 01062 Dresden, Germany*

[b] *Max Planck Institute for Chemical Physics of Solids, 01187 Dresden, Germany*

* E-mail: thomas.doert@tu-dresden.de

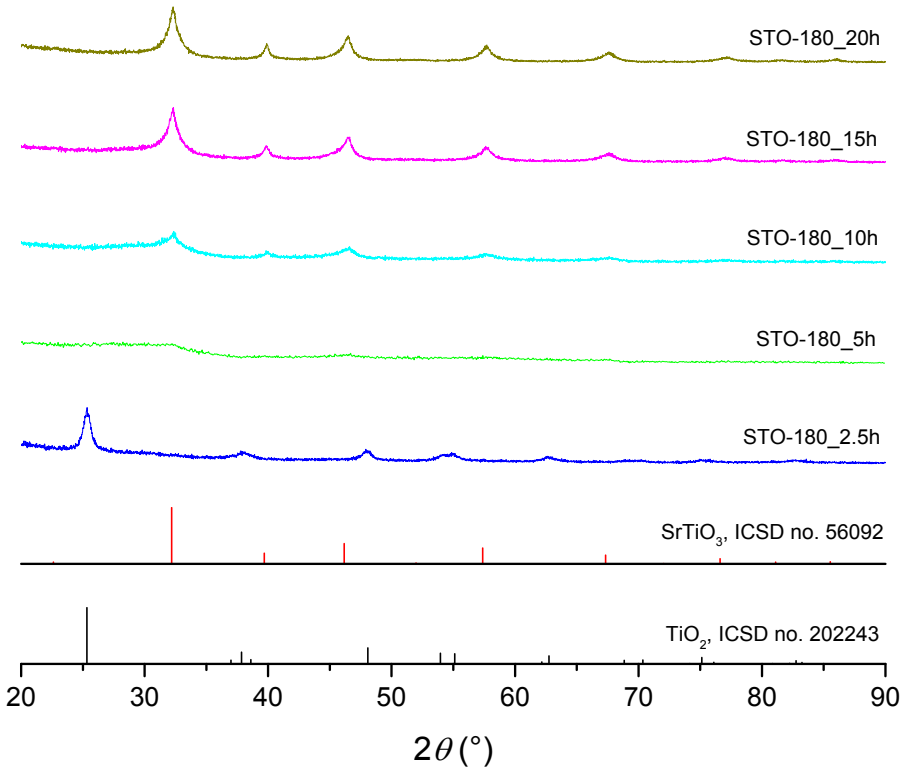


**Fig. S1** PXRD patterns of $SrTiO_3$ samples synthesized at 180 °C with different reaction times after calcination at 450 °C in air for 2h.

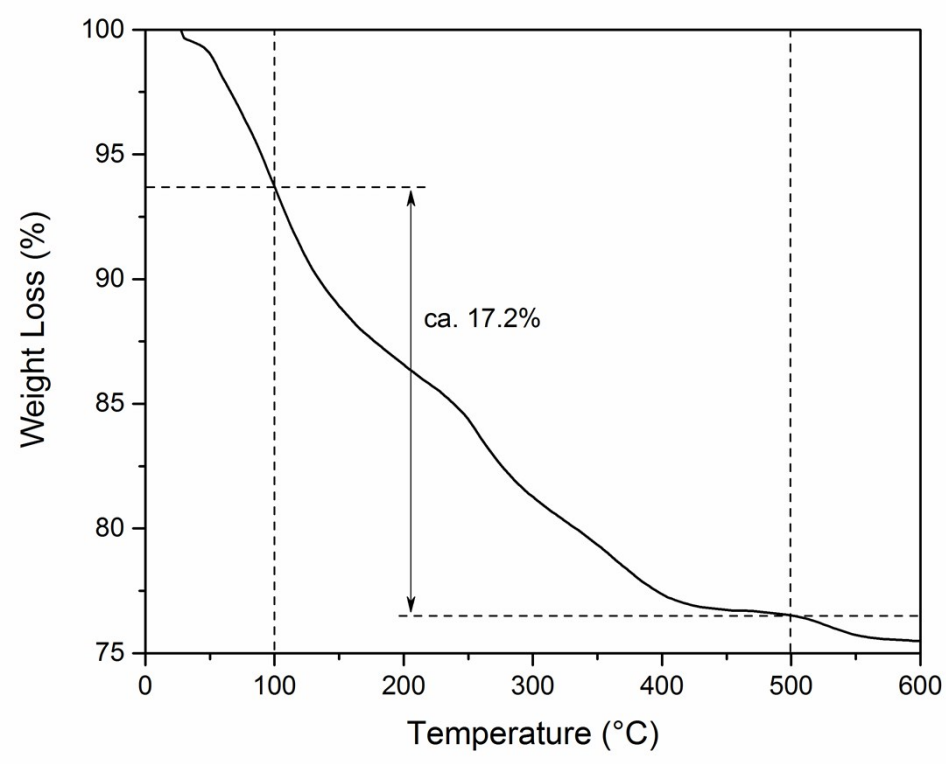


**Fig. S2** The TGA curve of the $SrTiO_3$ sample synthesized at 180 °C for 2.5 h.

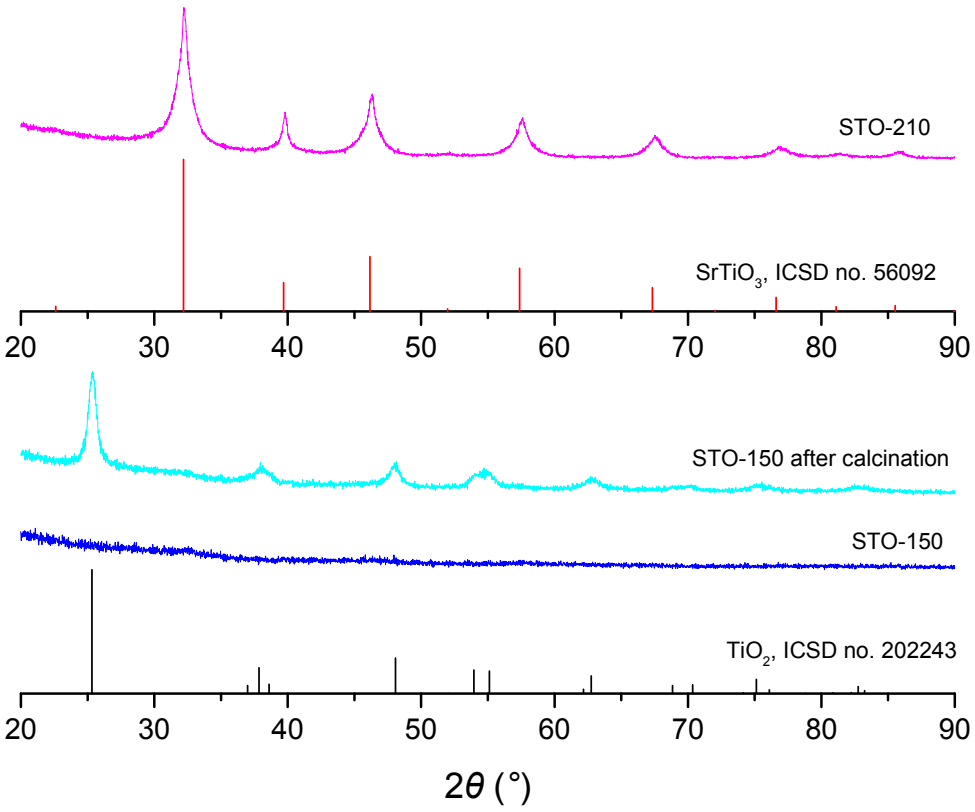


**Fig. S3** PXRD patterns of as-synthesized STO-150 sample, STO-210 sample, and STO-150 sample after calcination at 450 °C in air for 2h.

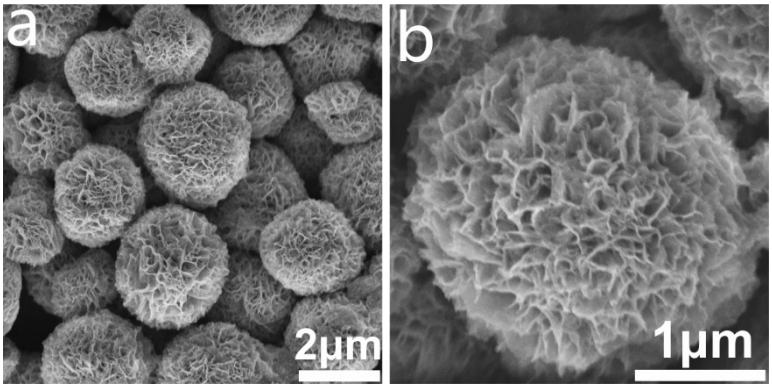


**Fig. S4** SEM images for as-synthesized STO-150 samples.

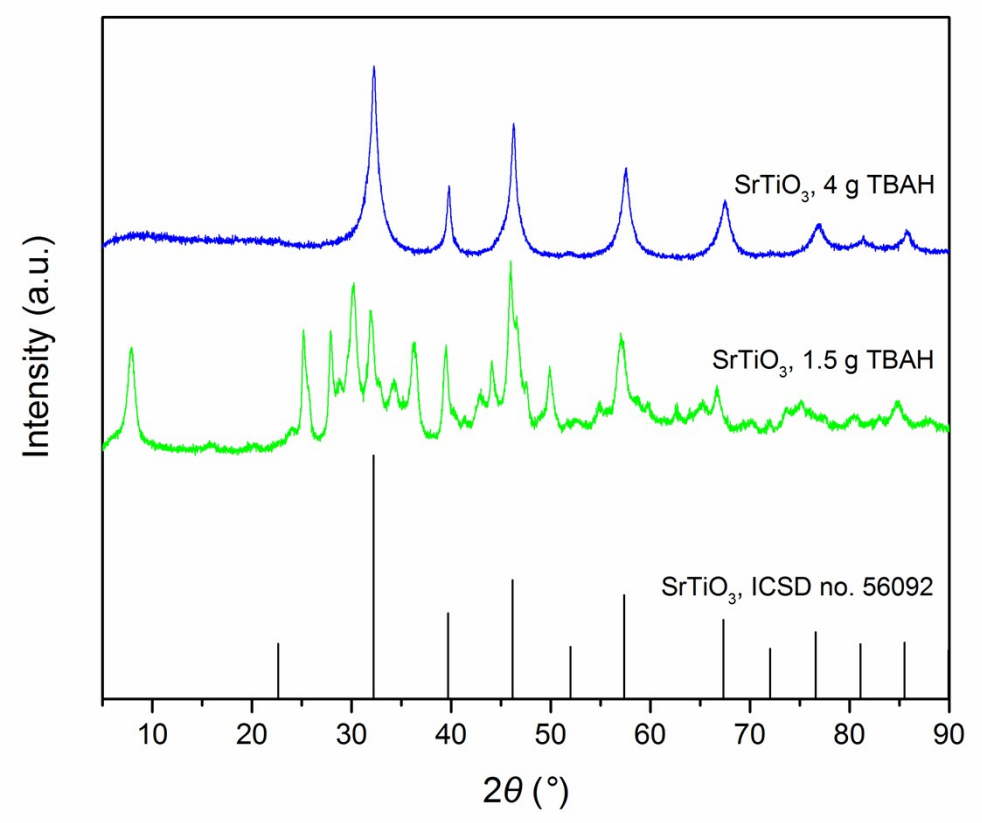


**Fig. S5** PXRD patterns of as-obtained $SrTiO_3$ samples using different amount of TBAH as reactants. The Ti-based product yields are 73.7% $SrTiO_3$ (135.2 mg) for the sample using 1.5 g TBAH as the reactant and 77.9% (143.0 mg) for the sample using 4 g TBAH as the reactant, respectively.

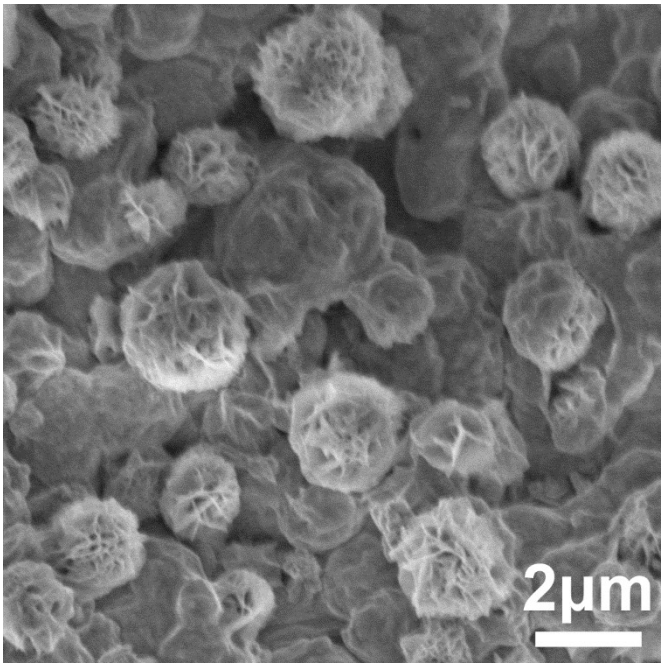


**Fig. S6** SEM image of as-obtained $SrTiO_3$ samples using 1.5 g TBAH as the reactant.

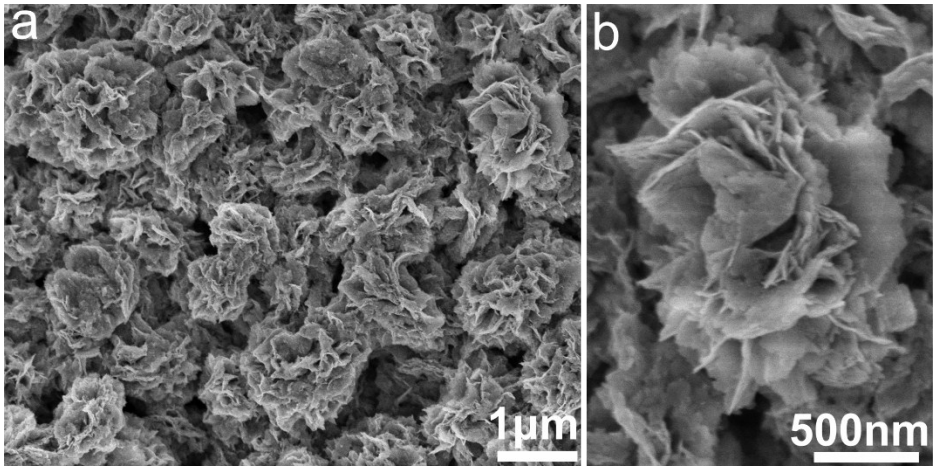


**Fig. S7** SEM images of as-obtained $SrTiO_3$ samples using 4 g TBAH as the reactant.

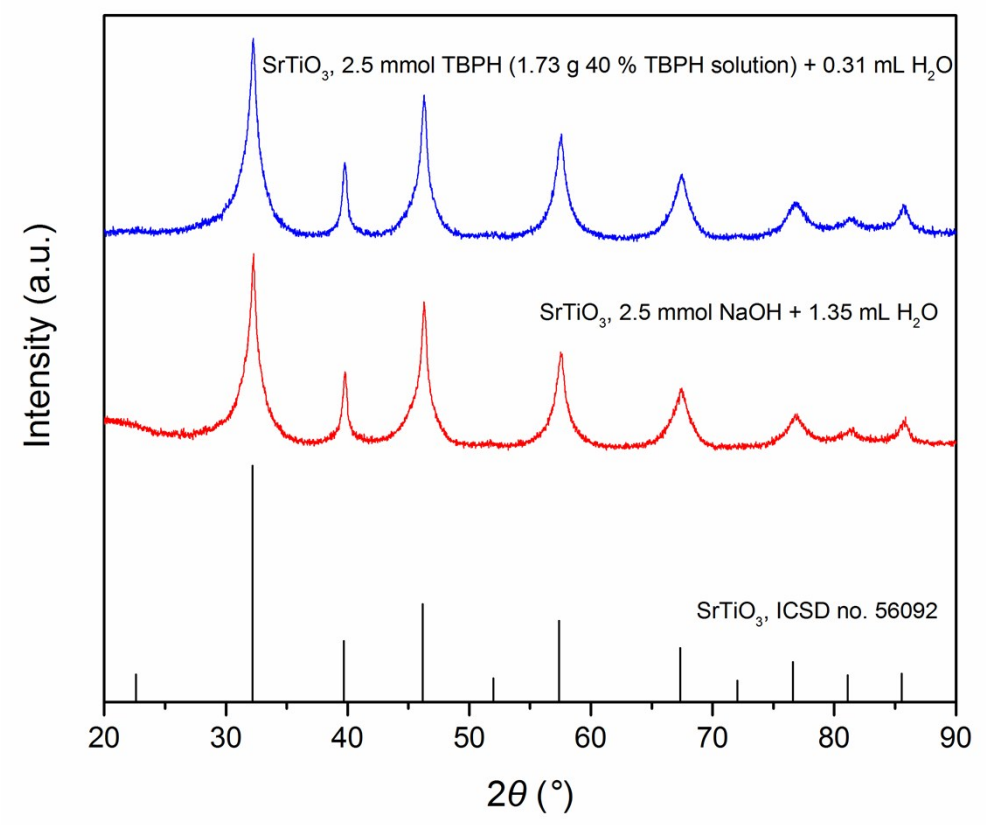


**Fig. S8** PXRD patterns of as-obtained $SrTiO_3$ samples using NaOH and tetrabutylphosphonium hydroxide (TBPH) as reactants. The Ti-based yields are 73.4% (134.7 mg) for the sample using NaOH as the reactant and 80.9% (148.5 mg) for the sample using TBPH as the reactant, respectively.

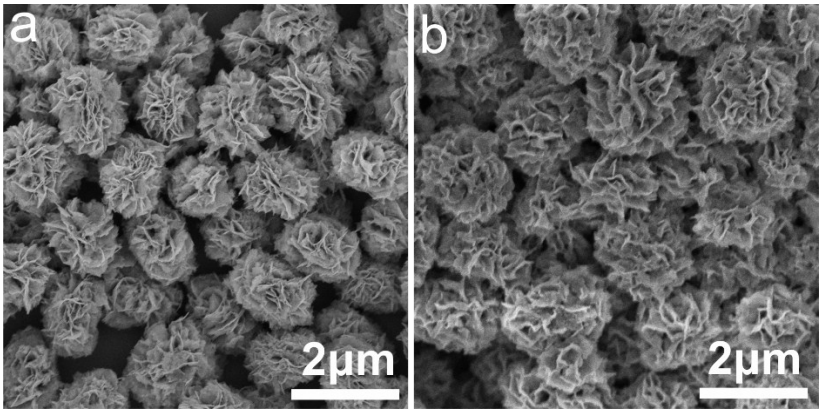


**Fig. S9** SEM image of as-obtained $SrTiO_3$ samples using NaOH (a) and TBPH (b) as the reactants, respectively.

## Electrophoretic preparation of the Ti/$SrTiO_3$ photoelectrode

The $SrTiO_3$ photoelectrode was prepared by an electrophoretic deposition method. Typically, 50 mg of ground $SrTiO_3$ powder were dispersed in 100 mL isopropanol. A small amount of $Mg(NO_3)_2{\cdot}6H_2O$ ($10^{-3}$ M; ≈ 25 mg) was added into the suspension in order to generate positive surfaces charges on the perovskite (by absorption of $Mg^{2+}$ ions) and to facilitate electro-migration. The suspension was continuously stirred for one hour and sonicated for 30 minutes at room temperature. For the electrophoretic deposition, the titanium foil was used as working electrode and a platinum foil was used as the counter electrode. A constant working voltage was set to 50 V and the electrophoretic deposition process was performed for 10 minutes. The final $SrTiO_3$-coated titanium foil was washed with distilled water to remove residual isopropanol and $Mg(NO_3)_2$ salt and dried at room temperature in the air before using.