Supplementary Information:

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

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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.
**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$_3$)$_2$·6H$_2$O ($10^{-3}$ M; $\approx$ 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.