Electronic Supplementary Information for Chemical Communications

Defective SrTiO$_3$ by Arc-melting
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1. Material Preparation
Commercial SrTiO$_3$ powders (99.5%, Aladdin) were pressed into a pellet and put in an arc furnace with a closed chamber filled with Ar. The samples were melted by the high temperature arc and rapidly cooled to room temperature by the Cu substrate with inside cooling water. Then the arc-melted pellet was grinded to powders for characterization.

2. Characterization
Crystal structure was tested by X-ray diffraction (XRD, D/max-2500, Rigaku, Tokyo, Japan). The defects in the samples were measured by X-ray photoelectron spectroscopy (XPS, Escalab 250Xi, Thermo Fisher Scientific, MA, USA). The in-plane magnetization measurements were performed with a superconducting quantum interference device (SQUID-VSM, Quantum Design, San Diego, USA), which features a sensitivity of $10^{-7}$ emu. The micrograph was taken by scanning electron
microscope (SEM, MERLIN VP Compact, Carl Zeiss, Germany). The microstructure of SrTiO$_3$ was characterized by transmission electron microscopy (TEM, JEM-2010, JEOL, Japan). The particle size of the powders was measured by laser scattering particle analyzer (Hydro 2000NW, Malver, Worcestershire, UK). Diffuse reflectance spectra were collected by UV-Vis-NIR spectroscopy (UV-2600, Shimadzu, Kyoto, Japan).

A photocatalytic degradation of rhodamine B (RhB) by pristine and arc-melted SrTiO$_3$ was carried out. The RhB solution (2.5 x 10$^{-5}$ molL$^{-1}$, 30 mL) with SrTiO$_3$ powders (1 mgmL$^{-1}$) was under ultrasound for 10 minutes and stirred for 30 min at dark place. The solution was then irradiated by a simulated solar light (Microsolar 300C, Perfectlight, Beijing, China), in which the density of the light was 0.2 Wcm$^{-2}$. The concentration of RhB was detected with a spectrophotometer (UV-2600, Shimadzu, Kyoto, Japan) at an interval of 15 minutes.

3. Supplementary Figures
Fig. S1 XPS spectra of Sr 3d for pristine and arc-melted SrTiO$_3$.

Fig. S2 TEM image of pristine SrTiO$_3$. No obvious disorder or strain caused by defects has been observed in the pristine SrTiO$_3$, indicating there are less defects in it.
Fig. S3 Particle size of arc-melted SrTiO₃ powders. It owns a mean particle size of 1.08 μm.

Fig. S4 SEM micrograph of pristine SrTiO₃ powders (A) and arc-melted SrTiO₃ powders (C); EDS of pristine SrTiO₃ powders (B) and arc-melted SrTiO₃ powders (D). We can see both pristine and arc-melted SrTiO₃ powders own similar particle size, indicating they have close surface area. From EDS data, both SrTiO₃ powders have same elements, suggesting no impure elements have been introduced in the arc-melting process.
Fig. S5 Solar driven photocatalytic activity of pristine and arc-melted SrTiO$_3$ powders under visible light ($\lambda > 400$ nm). The arc-melted SrTiO$_3$ powders show a certain degree of photocatalytic activity under visible light, that is, 50% of the RhB can be degraded within 135 min.