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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 (2.5×10^{-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

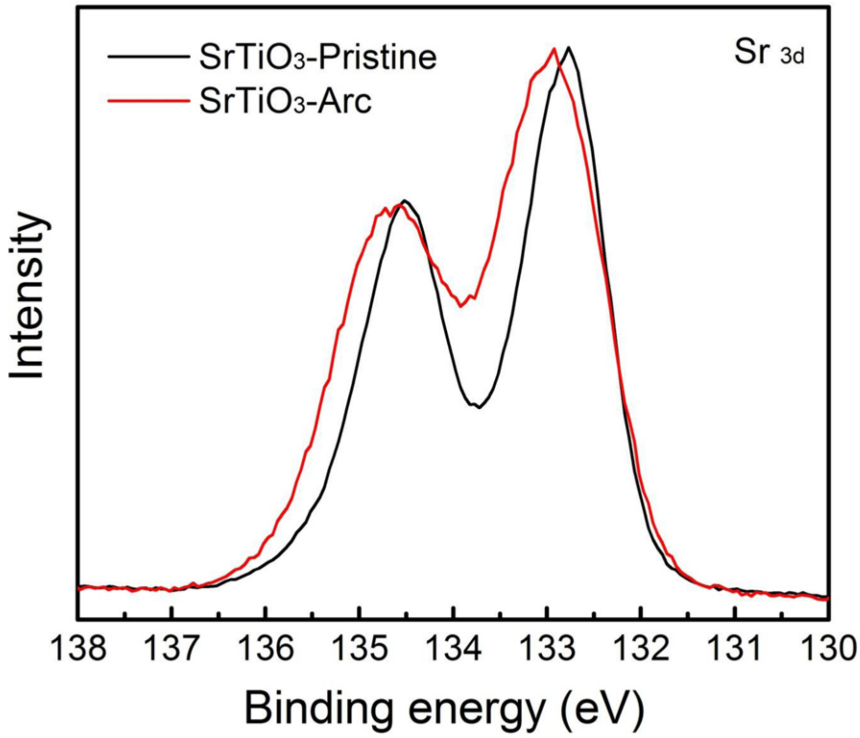

Fig. S1 XPS spectra of Sr 3d for pristine and arc-melted $SrTiO_3$.

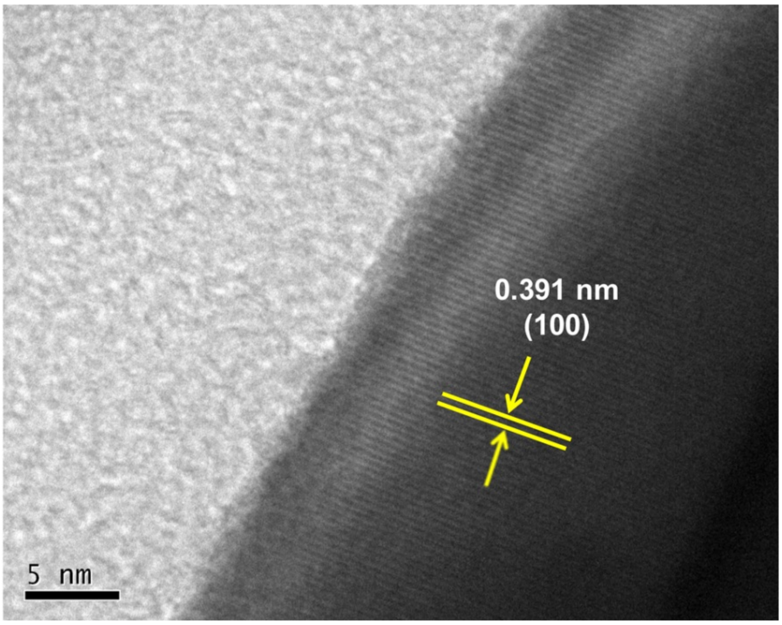

Fig. S2 TEM image of pristine $SrTiO_3$. No obvious disorder or strain caused by defects has been observed in the pristine $SrTiO_3$, indicating there are less defects in it.

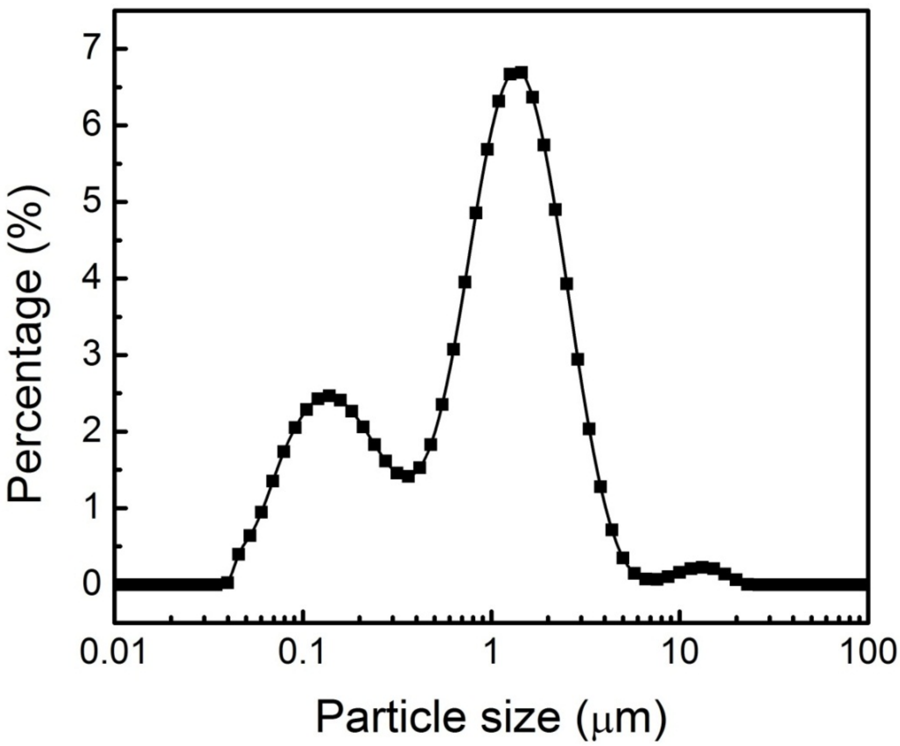

Fig. S3 Particle size of arc-melted $SrTiO_3$ powders. It owns a mean particle size of 1.08 μm.

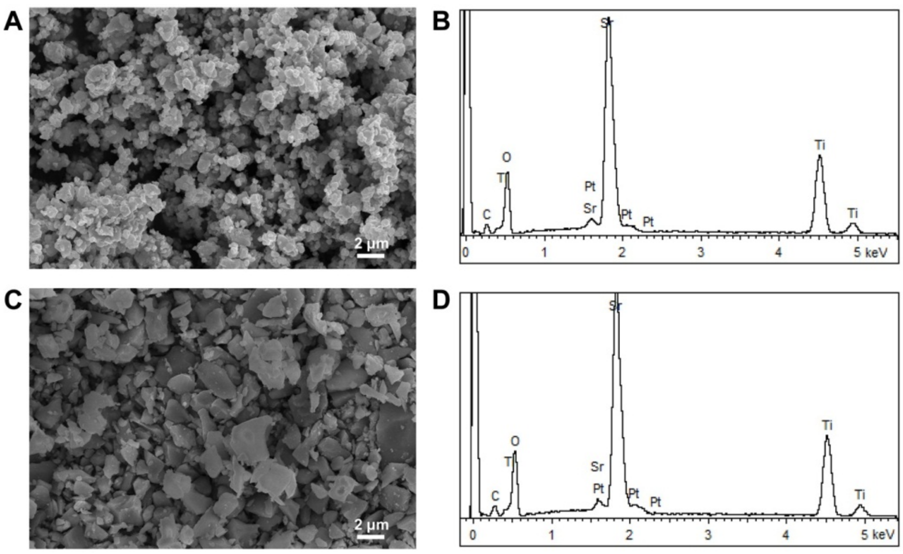

Fig. S4 SEM micrograph of pristine $SrTiO_3$ powders (A) and arc-melted $SrTiO_3$ powders (C); EDS of pristine $SrTiO_3$ powders (B) and arc-melted $SrTiO_3$ powders (D). We can see both pristine and arc-melted $SrTiO_3$ powders own similar particle size, indicating they have close surface area. From EDS data, both $SrTiO_3$ powders have same elements, suggesting no impure elements have been introduced in the arc-melting process.

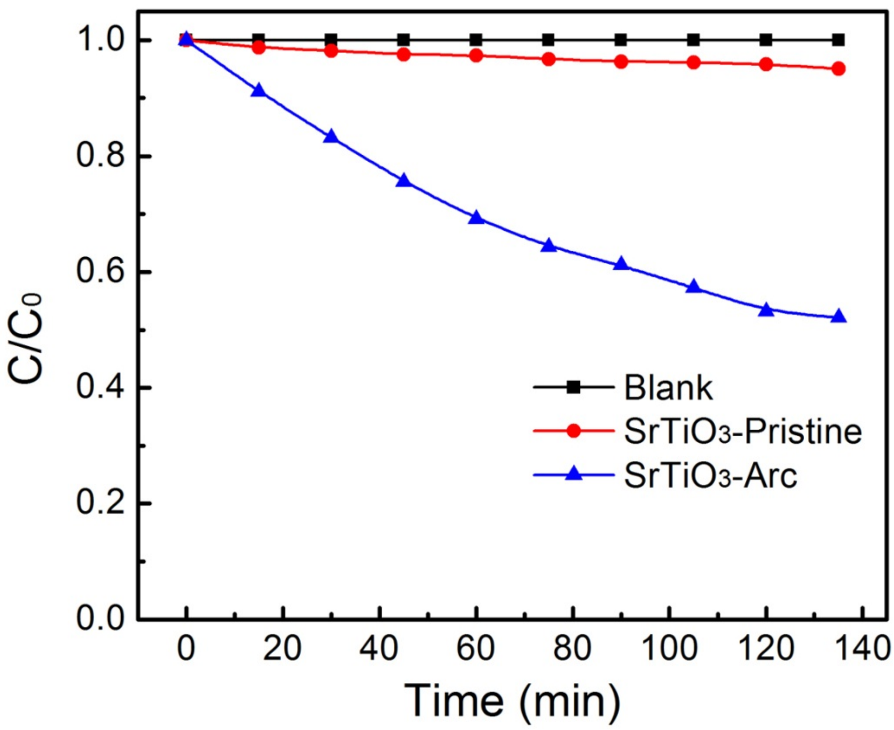

Fig. S5 Solar driven photocatalytic activity of pristine and arc-melted $SrTiO_3$ powders under visible light (λ> 400 nm). The arc-melted $SrTiO_3$ powders show a certain degree of photocatalytic activity under visible light, that is, 50% of the RhB can be degraded within 135 min.