Supporting Information

Enhanced photoredox water splitting of Sb-N donor-acceptor pairs in TiO_2

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Chemicals and materials

Melamine, Tetrabutyl titanate (TBOT), Sb_2O_3, ammonium molybdate and chromium chloride hexahydrate were purchased from Sigma-Aldrich. Ammonia solution (28%), ethanol and triethanolamine (TEOA) were purchased from Sinopharm Chemical Reagent Co. (Shanghai, China).

Characterization

X-ray diffraction (XRD) patterns were recorded on a Bruker D8 Advance Diffractometer (Germany) with Cu Kα radiation (λ = 1.5406 Å). X-ray photoelectron spectra (XPS) measurements were carried out using Thermo ESCALAB 250 instruments (USA) with non-monochromatic Al Kα 1486.6 radiation. Scanning electron microscope (SEM) was performed on a Hitachi S-3400N scanning electron microscope. The photoluminescence (PL) spectroscopy was measured using fluorescence spectrometer (Shimadzu RF-5301) at the excitation wavelength of 320 nm. The specific surface area was determined from the linear part of the BET equation (P/P_0 =0.05–0.25). The pore size distribution was derived from the desorption branch of the N_2 isotherm using the Barrett–Joyner–Halenda (BJH) method. Fourier transform infrared (FT-IR) spectra were measured using a Nicolet Magna-IR 750 spectrophotometer. UV-vis absorption spectra analysis was performed using a Shimadzu UV 3600 spectrometer. In photoelectrochemical measurements, $MgSO_4$ solution was used as electrolyte and the tests were performed by switching visual light ON/OFF with a duration of 30 s in a typical three-electrode cell.

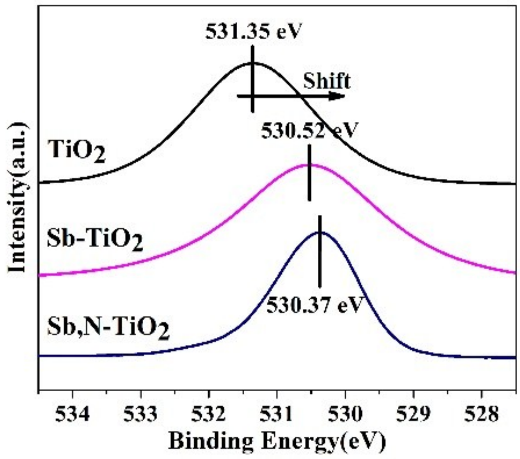

Fig. S1 The binding energy of O in TiO_2, Sb-TiO_2 and Sb, N-TiO_2.

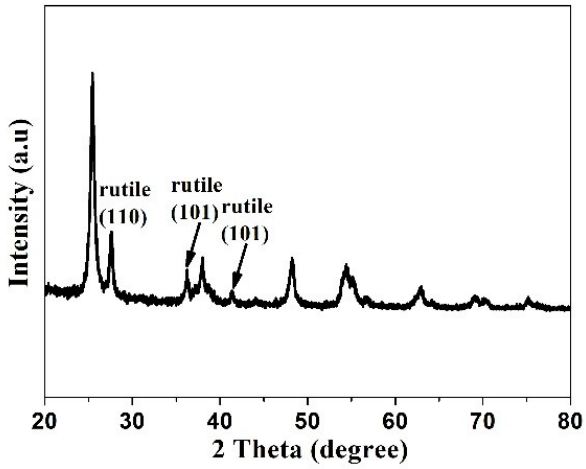

Fig. S2 XRD pattern of Sb,N-TiO_2 calcined at 550 ℃.

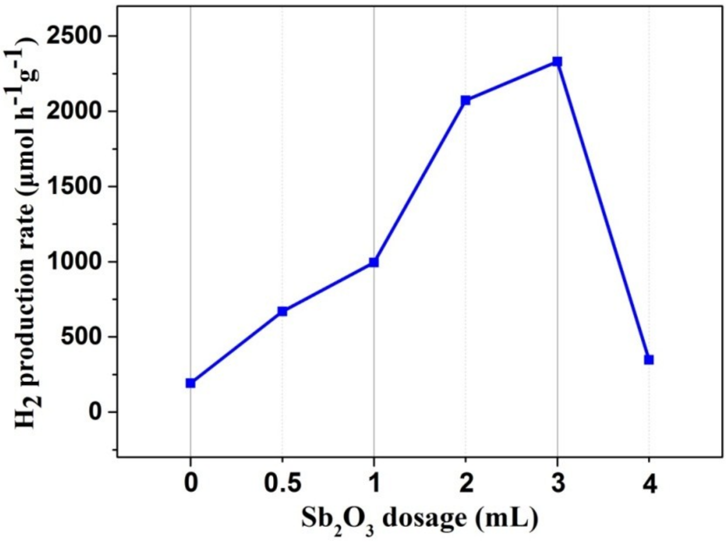

Fig. S3 Correlation between solar-light H_2 production and Sb_2O_3 dosage.

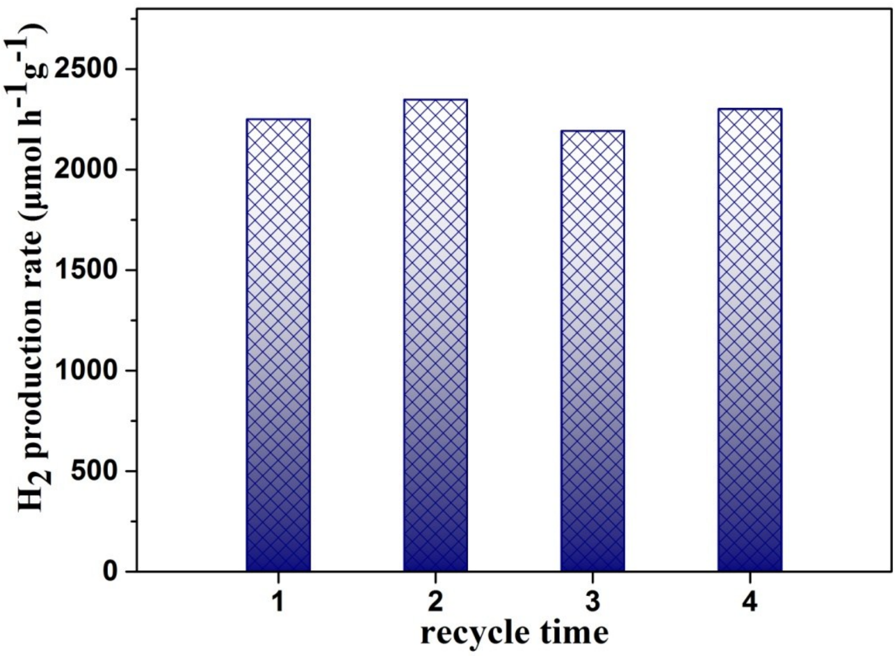

Fig. S4 Stability test of Sb,N-TiO_2 by adding 3 mL TEOA in the next cycle.

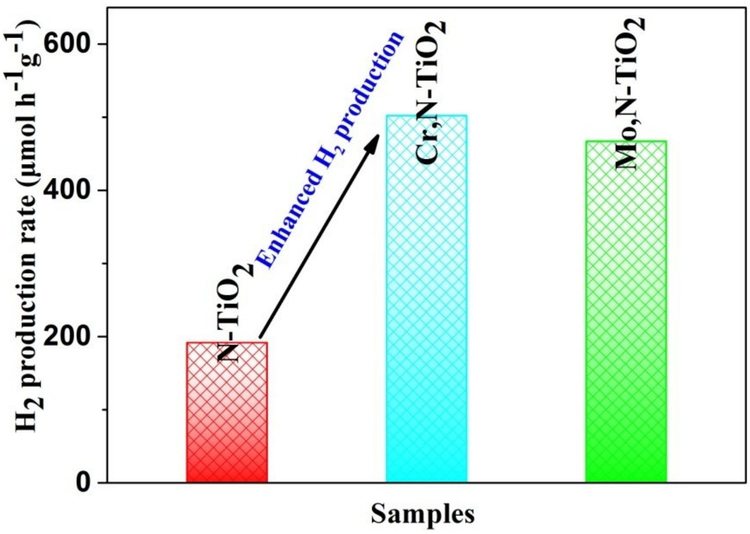

Fig. S5 Solar-light H_2 production of Cr,N-TiO_2 (synthesized in $CrCl_3 \cdot 6H_2O$ dosage of 0.3 g and melamine dosage of 3 mL) and Mo,N-TiO_2 (synthesized in $H_8MoN_2O_4$ dosage of 0.3 g and melamine dosage of 3 mL).

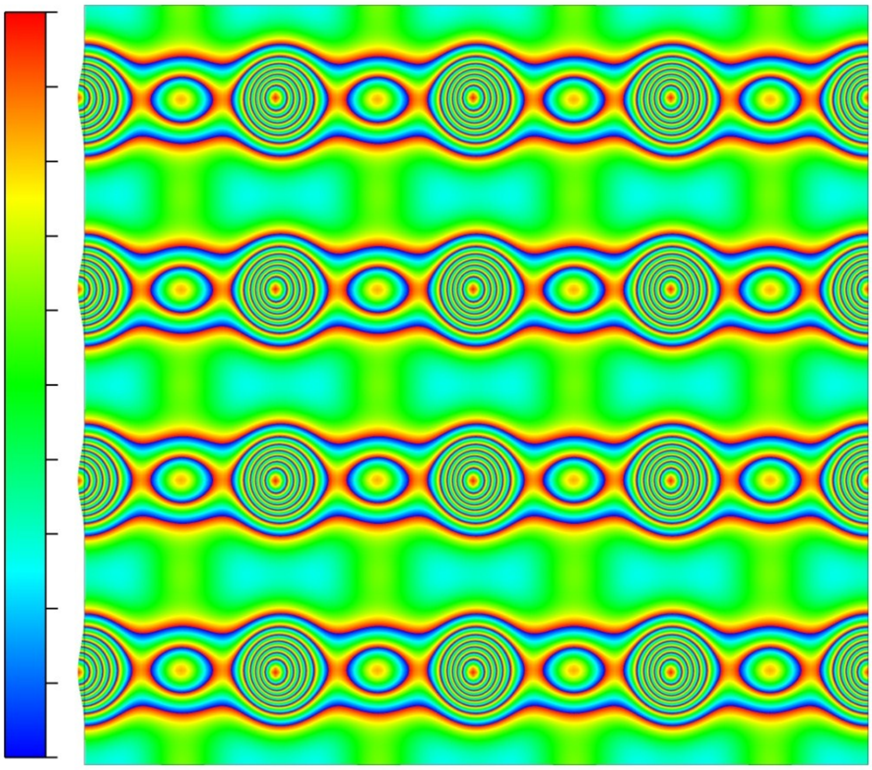

Fig. S6 Electron density in (001) plane of massive TiO_2.