Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Synergistic design for enhancing solar-to-hydrogen conversion over TiO_2 based ternary hybrid

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EXPERIMENTAL SECTION

Catalyst characterization. The XRD patterns were recorded on an powder X-ray diffractometer with Cu Ka radiation (D8 Advance Bruker Inc., Germany). Raman spectroscopy was conducted using a microscopic confocal Renishaw 1000 NR Raman spectrometer. The morphology was analyzed using TEM on a JEOL JEM-2010 and a Tecnai G2 F20 S-TWIN. X-ray photoelectron spectroscopy (XPS) was measured on a Thermo Fisher ESCALAB 250Xi X-ray photoelectron spectroscope equipped with Al Kα radiation operated at 200 W. The Fourier transform infrared spectra (FTIR) of the samples were recorded using a Nicolet iS50FT-IR spectrometer (Thermo, USA). The Brunauer–Emmett–Teller (BET) specific surface area was evaluated using a nitrogen adsorption–desorption apparatus (ASAP 2040, Micrometrics Inc., USA) with all samples degassed at 120 ^{o}C for 12 h prior to measurements. UV–vis diffuse reflectance spectra were obtained for the dry-pressed disk samples using a Shimadzu UV-3100 recording spectrophotometer equipped with an integrating sphere. PL measurements were conducted with a fluorescence spectrometer (F-4600, Hitachi Inc., Japan) at room temperature.

Photoelectrochemical measurements. The photocurrent and electrochemical impedance measurement were performed on a CHI 660D electrochemical work station (Chenhua Instrument, Shanghai, China) in a conventional three electrode configuration with Pt foil as the counter electrode and Ag/AgCl (saturated KCl) as the reference electrode. 0.1 M Na_2SO_4 aqueous solution was used as the electrolyte. The

working electrodes were prepared as follows: 10 mg of the prepared photocatalyst and 0.5 mL Nafion dispersing reagent were added into 5 mL absolute ethyl alcohol and sonicated for 30 min. The resulting slurry was then spread on a 2.5×1.0 cm indium–tin oxide (ITO) glass substrate and dried in air. In addition, a 300 W Xe lamp was utilized as the light source ($\lambda > 420$ nm) during the photocurrent measurement.

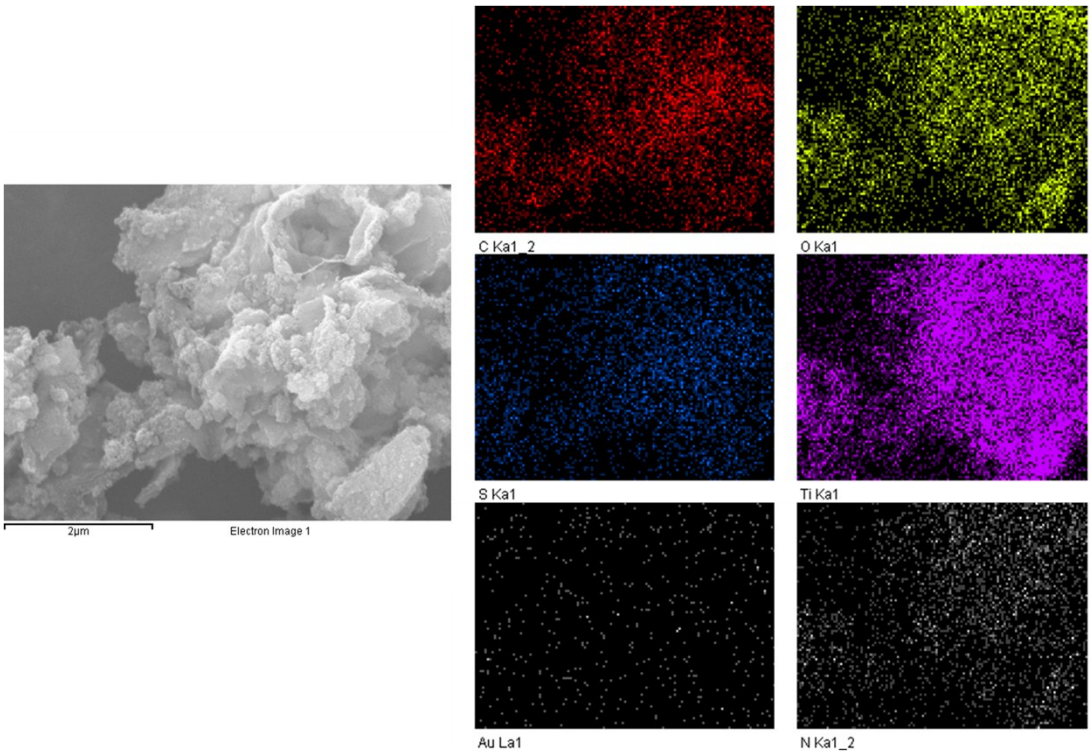

Figure S1. Typical SEM image of BE-Au(1wt%)-TiO_2-16.7 hybrid and corresponding elemental mapping images.

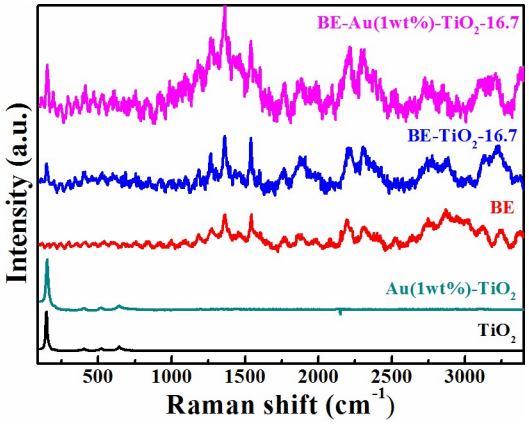

Figure S2. Raman spectra of series of catalysts.

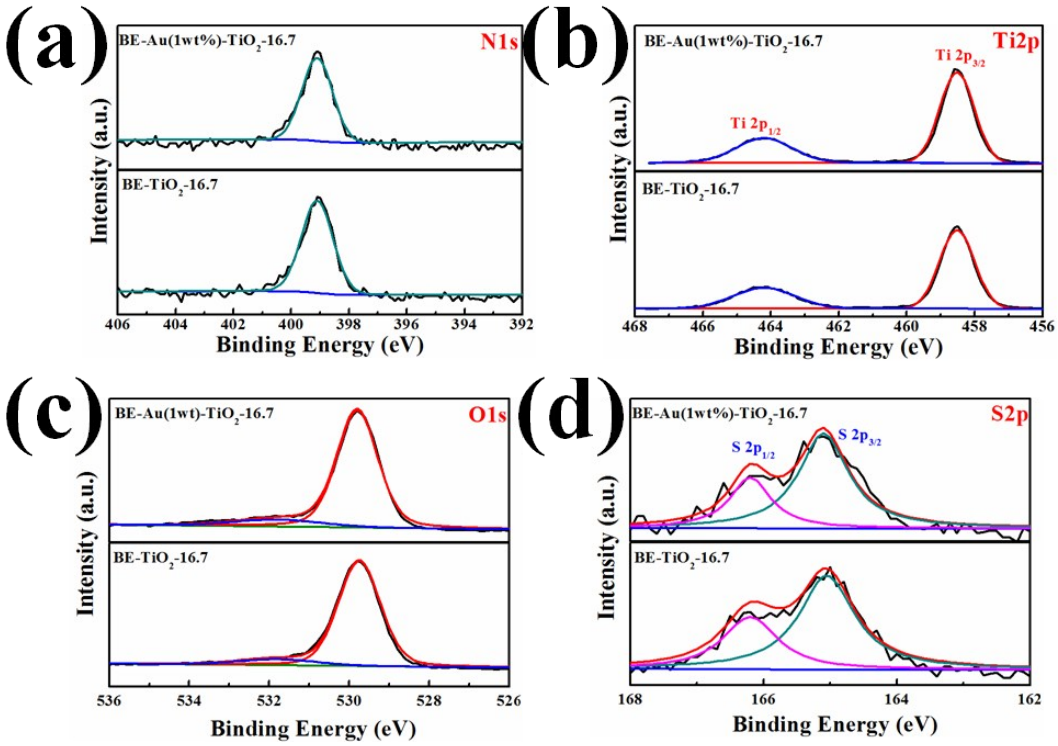

Figure S3. XPS spectra of N, Ti, O and S of the catalyst.

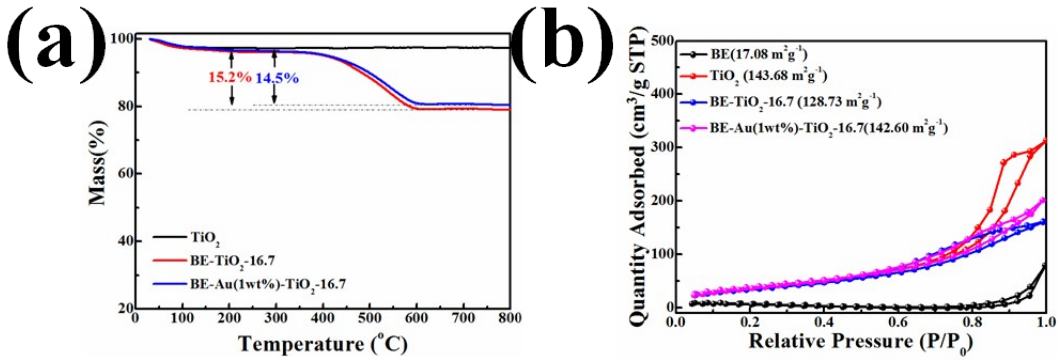

Figure S4. (a) Thermal and (b) BET analysis of series of catalysts.

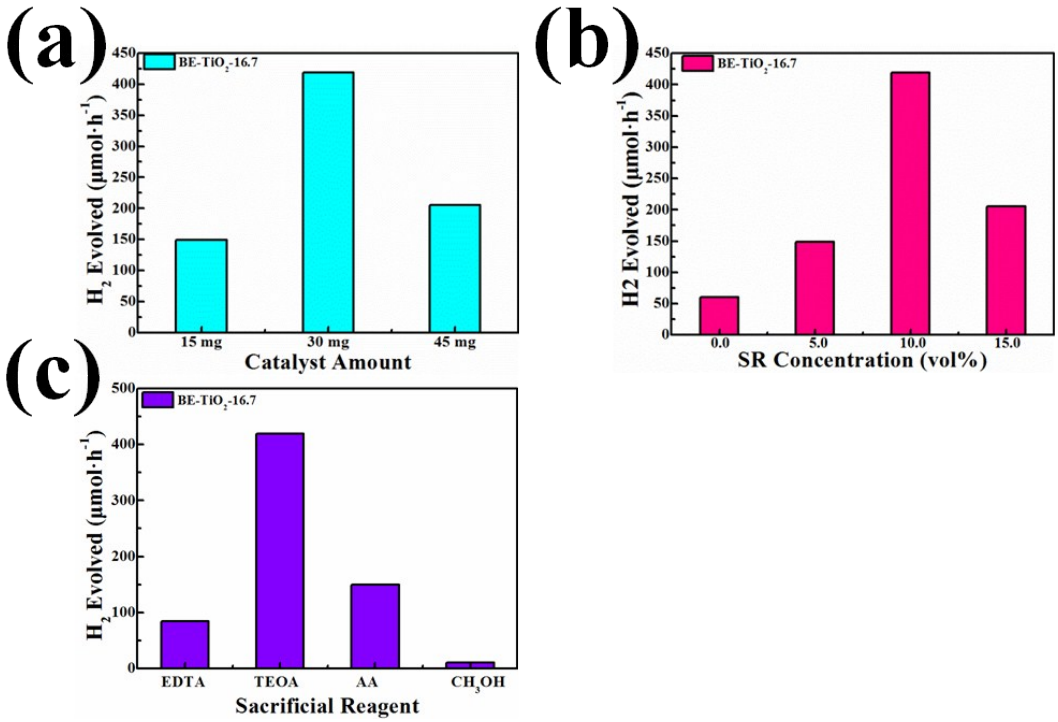

Figure S5. Effect of concentration of catalyst (a), TEOA (b) and type of sacrificial reagent on the H_2 production activity of BE-TiO_2-16.7 composite.

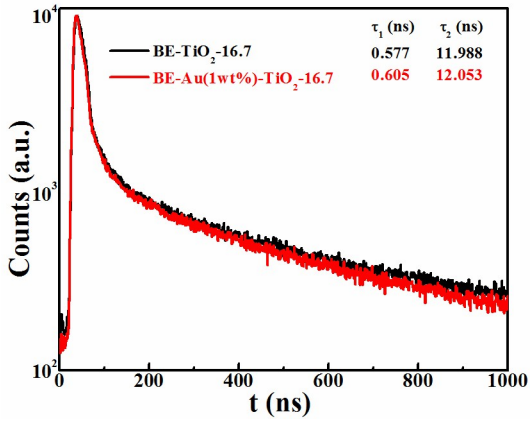

Figure S6. Time-resolved fluorescence spectra of BE-TiO_2-16.7 and BE-Au(1wt%)-TiO_2-16.7.