Supplementary Information

Experimental Section

S1. Materials.

PW_{12} was prepared according to literature method and identified by UV-vis adsorption spectrum and cyclic voltammetry.\textsuperscript{1} The PW_{12}/TiO\textsubscript{2} composite was prepared as follows. One grams of commercial titanium dioxide (P25) were added to a solution prepared by dissolving a determined amount of PW_{12} in 10 mL HNO\textsubscript{3} aqueous solution (pH = 1.5). The mixture was heated at 333 K under continuous stirring until the solvent was completely evaporated. The resultant solid was then calcined at 473 K during 3 h in an oven. The samples prepared in this way have different molar ratios of PW_{12} and TiO\textsubscript{2}, which include 0.0015:1, 0.01:1, 0.015:1, 0.02:1, and 0.15:1. They are denoted as PT-1, PT-2 PT-3 PT-4 and PT-5, respectively. Other reagents were of AR grade. The water used in all experiments was deionized to a resistivity of 18 M\textOmega\ cm.

S2. Fabrication of photoconductive device.

First, a conducting glass (SnO\textsubscript{2}: F-coated glass, FTO glass) was isolated with a nonconducting gap by a sharp knife. Each piece of the FTO was adopted as an electrode. The gap between the two electrodes is ca. 450 \mu m. Then, the PW\textsubscript{12}/TiO\textsubscript{2} composite (0.2g) was dispersed in ethanol (1 mL) by ultrasonication. Finally, the obtained mixture was coated over the surface of the gap between the two electrodes by doctor blade technique, getting a composite film. After air drying, the photoconductive device formed. For comparison, the TiO\textsubscript{2} photoconductive device was prepared in a similar way.
S3. Characterization.

Infrared spectra (IR) were recorded with a Nicolet Magna 560 FT-IR Spectrometer. X-ray diffraction (XRD) analyses were performed with a Rigaku D/max-3c X-ray diffractometer, using CuKα1 radiation (\(\lambda = 1.5405\) Å). Field-emission scanning electron microscopy (Hitachi SU-8010 FE-SEM) was used to investigate the surface morphology. All electrochemical experiments were performed on a CHI660C Electrochemical Workstation (Shanghai Chenhua Instrument Corp., China) at room temperature. A two-electrode system was employed with each piece of the FTO as an electrode. The photoconductivity of the samples was measured by monitoring their photocurrent response under light irradiation. All photocurrent experiments were carried out at a constant bias of 1 V. A 500 W xenon lamp (320 nm \(\leq \lambda \leq 780\) nm) was used as a light source, and the average intensity reaching the composite films was measured to be ca. 50 mW \(\cdot\) cm\(^{-2}\).

To investigate the gas sensitivity of the samples, the device was placed in an air-proof test box with a quartz window. A special volume of acetone solution was injected into the box with a microsyringe. Following injection, acetone solution, which is highly volatile at room temperature, will produce acetone vapors. In this system, air was used both as a reference gas and a diluting gas to get desired concentrations of acetone. In addition, all the tests were operated at a relative humidity of 22±5%.

References

1 H. Wu, J. Biol. Chem., 1920, 43, 189.
Fig. S1 Photocurrent response of PT-4 device at 300 ppm acetone gas.