Appendix I

At room temperature, the Cu Kα irradiation in Tongda-3500 diffractometer was used to test X-ray diffraction (XRD) patterns of all samples, which was employed to characterize the crystal phase composition. The morphology and the energy disperse spectroscopy (EDS) mapping of the samples was photographed by the Zeiss Sigma 500 scanning electron microscope (SEM) and the accessory energy spectrometer. The transmission electron microscope (TEM) images were obtained by using the JEOL 2100F instrument with 200 kV accelerating voltage. The Raman spectroscopy was tested via the Horiba HR Evolution Raman spectrometer with 532 nm excitation wavelength to judge the functional groups information in the samples. The Escalab 250Xi photoelectron spectrometer was used to analyze the chemical composition and the valence states in the samples. The Tristar 3020 instrument was used to measure the specific surface area and the pore diameter. The PerkinElmer Lambda 950 was used to test the ultraviolet visible diffuse reflection spectroscopy of the samples. The fluorescence lifetime and quantum efficiency were measured by using FLS980 spectrograph.

Appendix II

50 mL of lomefloxacin and tetracycline antibiotic solutions with a concentration of 10 mg/L were stirred fully, and then 5 mL of the solution was taken out to measure the initial absorbance with an ultraviolet-visible spectrophotometer. 100 mg of the sample was dispersed into the above solution and was magnetically stirred again for 45 minutes under dark conditions. 5 mL of solution was taken out at every 15 minutes and the catalyst was removed by centrifuge to obtain the absorbance of supernatant under dark reaction. After the adsorption and desorption equilibrium, the lamp was turn on to conduct the light reaction. The power and wavelength range of the mercury lamp were 250 W and 200 nm-600 nm, while the xenon lamp parameters were 300 W and 300 nm-2000 nm. At every 15 minutes, 5 mL of solution was taken out and washed with a centrifuge. The supernatant was put into the cuvette to record the absorbance. The absorption wavelengths of the lomefloxacin and the tetracycline were set as 286 nm and 356 nm. The addition of benzoquinone (BQ), disodium ethylenediaminetetraacetic acid (EDTA-2Na), isopropanol (IPA) and $AgNO_3$ was used to explore the types of active radicals in the photoreaction process. The drinking waters were acted as solvents to study the application prospect of the catalyst.

Appendix III

A CHI600E electrochemical workstation with three electrode system was used to measure photocurrent response and electrochemical impedance spectroscopy. The counter electrode was a Pt wire, while and a saturated calomel electrode was acted as the reference electrode. The working electrode was prepared using the pure phase samples or the γ-Bi_2O_3/CeO_2-21 sample. 10 mg of the sample was dissolved into 40 μL of ethanol solution (volume ratio, H_2O:CH_3OH=1:1). After 20 minutes of ultrasonic treatment, 10 μL of naphthol was added into the suspension solution. The obtained paste was dropped onto the FTO glass (1 cm^2×2 cm^2) to prepare a uniform film. After drying, it was the working electrode. The electrolysis of the three electrode system was 0.5 mol/L Na_2SO_4 solution and the light source was the xenon lamp with the emission wavelength λ≥420 nm. The electrochemical impedance spectrum was measured under the condition of an open circuit potential. Upon Mott-Schottky measurement, the above paste was dropped onto a glassy carbon electrode and the test mode was under a fixed frequency direct current potential polarization.

A JES FA200 spectrometer (JEOL, Japan) was employed to measure the electron spin resonance signals of free radicals and 5,5-dimethyl-1-pyrroline N-oxide (DMPO) was used to capture these signals. 30 mg of γ-Bi_2O_3/CeO_2-21 sample and a certain amount of 40mmol/L DMPO solution were dispersed into methanol for $O_2^{-\bullet}$ free radicals and into aqueous solution for $OH^{-}\bullet$ free radicals. A 300 W xenon lamp was used to irradiate the above solution. The intermediate products upon the degradation processes of the lomefloxacin and the tetracycline were detected using liquid chromatography-mass spectrometry (LC-MS). The chromatographic column was an agilent XDB C18 chromatographic column (3.0 μm×46 cm). The mobile phase was a mixture of methanol and formic acid aqueous solution (0.1%), with a flow rate of 0.6 mL/min.

Appendix IV

On the super clean table, the Escherichia coli solution (ATCC25922) was inoculated into 50 mL Luria-Bertani medium. The above solution was placed in a 37°C constant temperature shaker with rotary speed 120 rad/min for 14 hours to obtain Escherichia coli suspension I. The suspension I was further cultured under the above conditions to obtain the Escherichia coli suspension II. Three sets of controlled experiments named the test tubes 1, 2 and 3 were conducted simultaneously. 3 mL of the solutions after dark reaction and degradation were added into the test tube 1 and 2. The same volume of physiological saline water was placed into the test tube 3. 1 mL of Luria-Bertani medium and 1 mL of the Escherichia coli suspension II were added to the above three test tubes, respectively. All test tubes were cultivated in a constant temperature shaking box at 37°C and 120 rad/min for 24 hours. After 0, 2, 5, 8 and 24 hours of culture, some solutions were taken out to measure the optical density (OD, λ=600 nm) of the Escherichia coli via a microplate reader. In order to determine the colony count of Escherichia coli, 100 μl solution was taken out from three test tubes cultured after 8 hours, and the colony number of the Escherichia coli was determined by 10 times dilution.

Appendix V

For CeO_2 bulk, the atom model was optimized and then the hybrid functional self-consistent calculation was completed by adding AEXX=0.17 in INCAR file. The energy band configuration and the band edge charge density were obtained. The surface models of CeO_2 and γ-Bi_2O_3 were built to cleave the crystal faces of (100) and these two models were optimized fully with the fixed z axis. After relaxation, the LOCPOT file was obtained by setting the LVTOT and the dipole moment correction parameters into the INCAR file. The CeO_2/γ-Bi_2O_3 interface model was constructed by loading a CeO_2 (100) surface model onto the (100) crystal face of γ-Bi_2O_3. The vacuum layer thickness was set as 36 Å to avoid mirror interaction. The charge density difference Δρ was calculated as ρ(CeO_2/γ-Bi_2O_3)-ρ(CeO_2)-ρ(γ-Bi_2O_3).

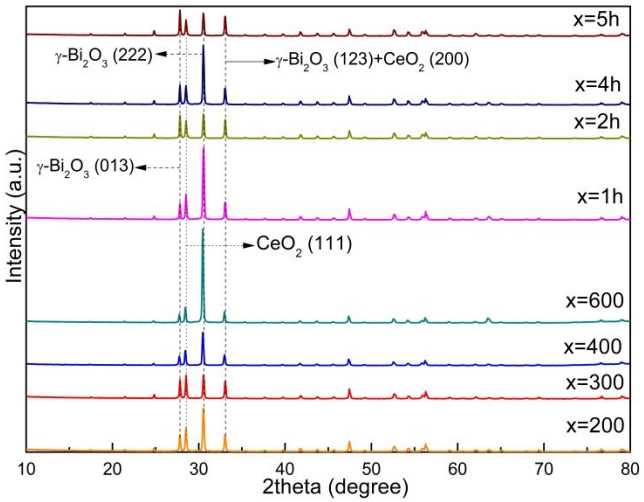

Figure S1 XRD patterns of the rest heterojunction samples

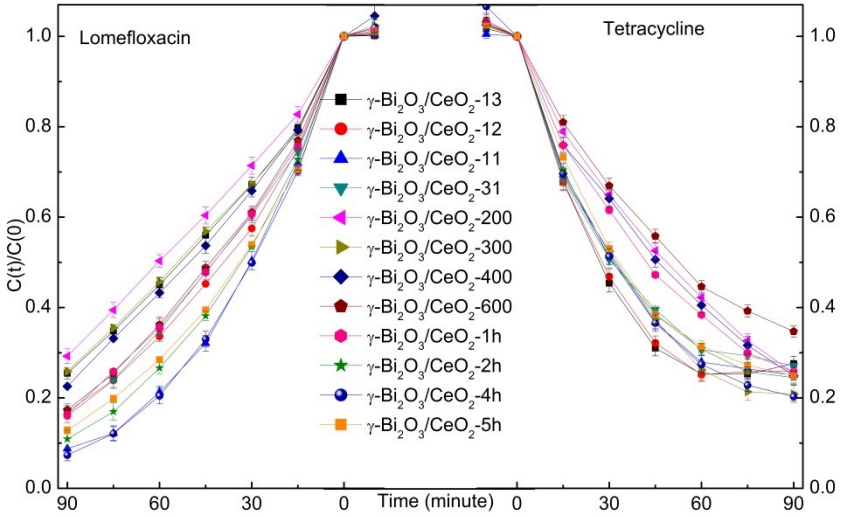

Figure S2 Degradation curves of lomefloxacin and tetracycline upon other samples

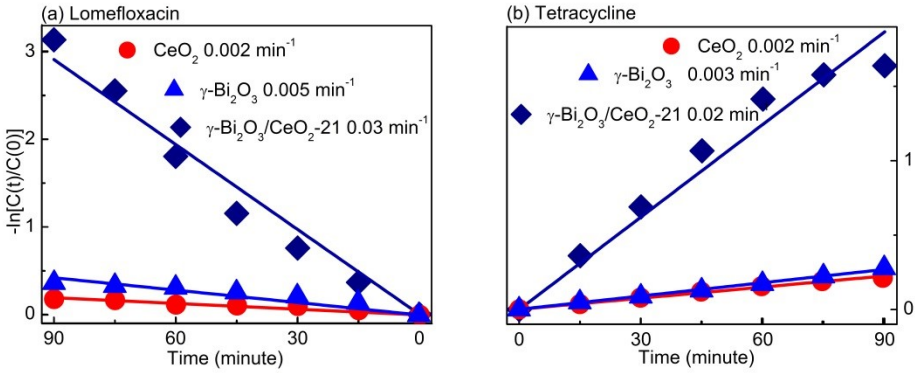

Figure S3 First-order degradation rate constants upon three typical samples

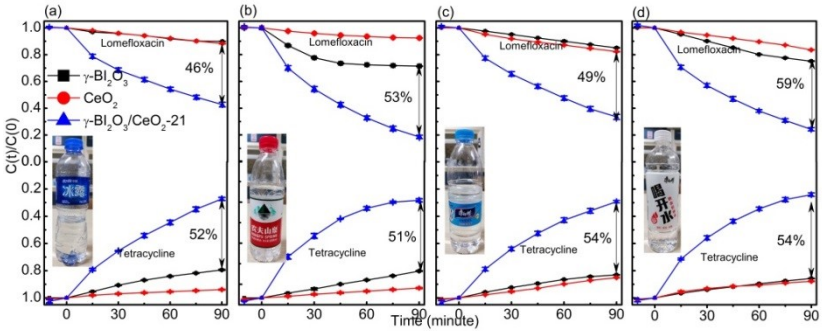

Figure S4 Increment quantities in mineral waters of Binglu (a), Nongfushanquan (b), Kangshifu (c), Hekaishui (d)

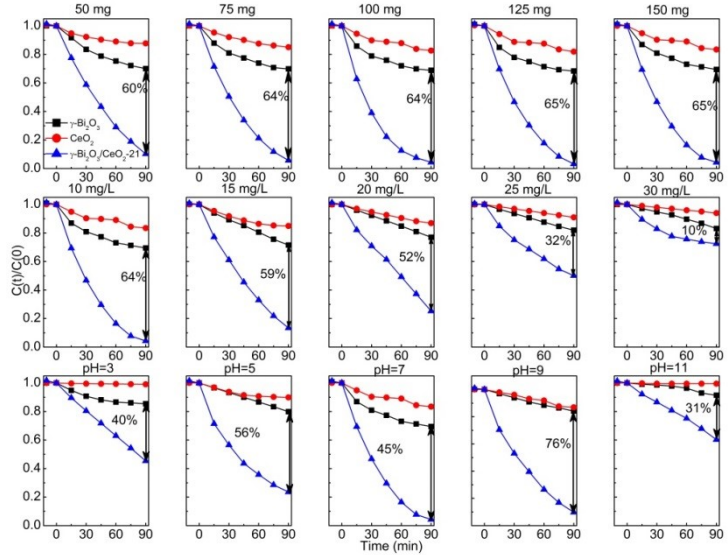

Figure S5 Lomefloxacin degradation efficiency for different initial conditions

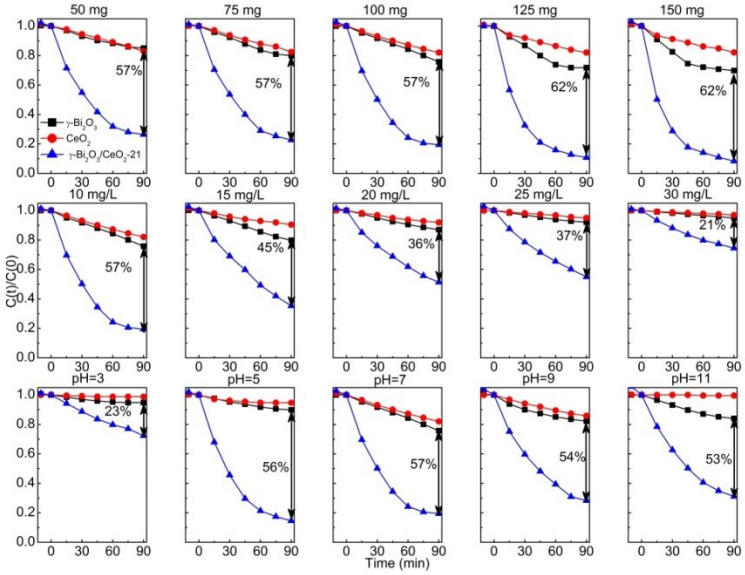

Figure S6 Tetracycline degradation efficiency for different initial conditions

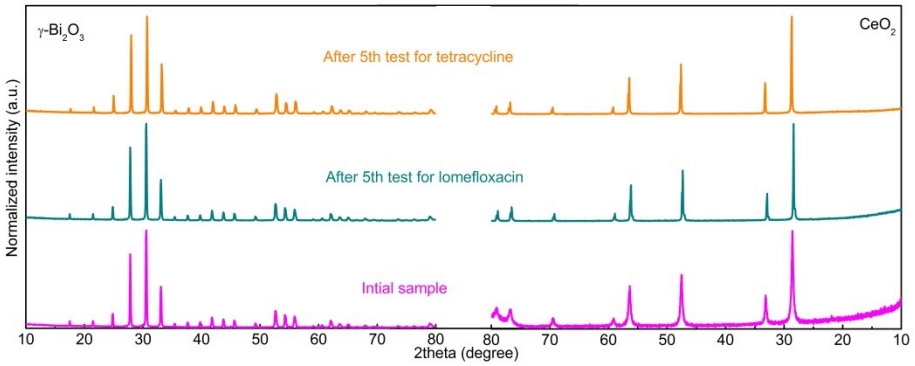

Figure S7 XRD profiles of the pure phase samples upon before and after the fifth cycling test

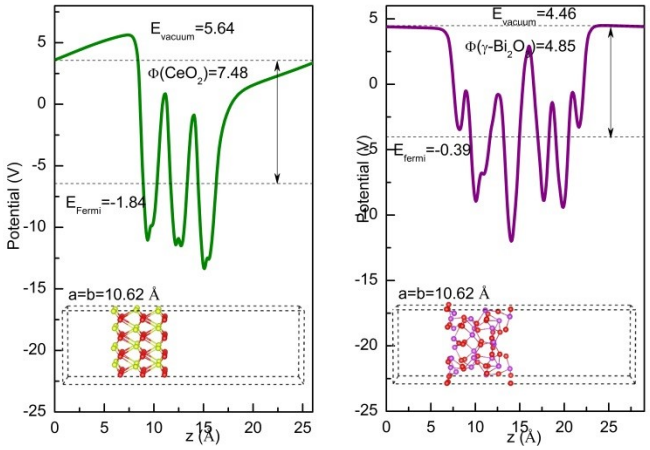

Figure S8 Optimized structures and electrostatic potential curves of CeO_2 (100) and γ-Bi_2O_3 (100) surfaces

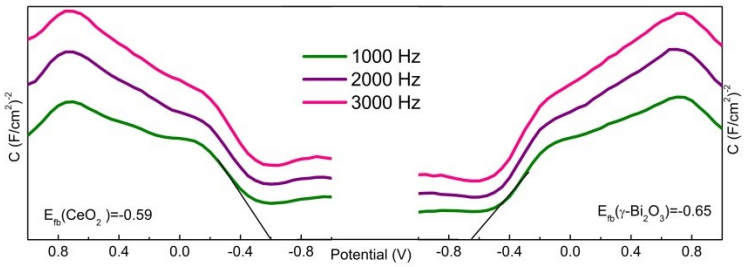

Figure S9 Mott-Schottky curves of CeO_2 and γ-Bi_2O_3

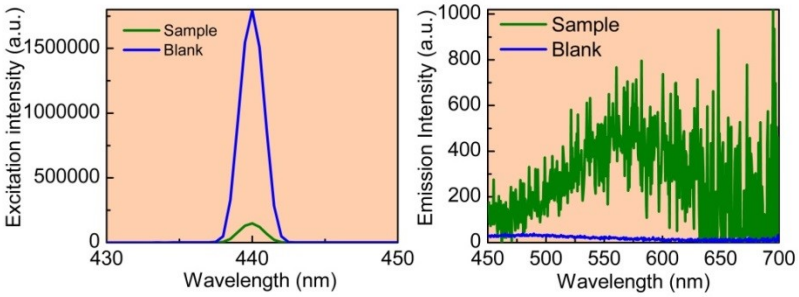

Figure S10 Quantum efficiency test for the optimal sample

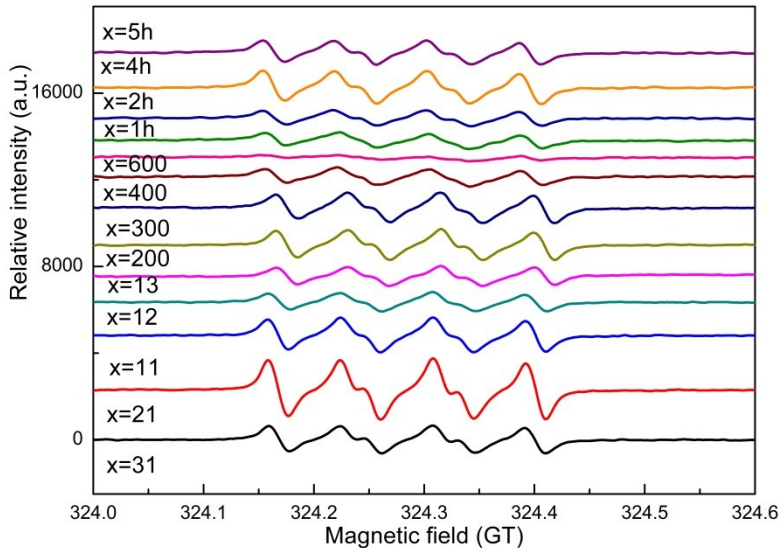

Figure S11 Electron spin resonance signals of DPMO-$O_2^{-\bullet}$ for all heterojunction samples

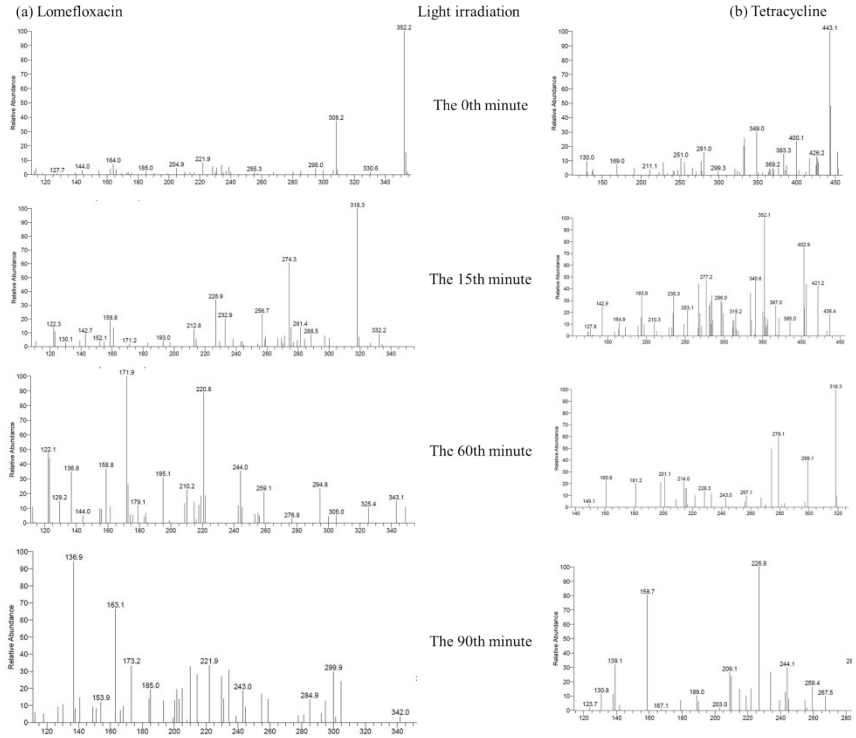

Figure S12 LC-MS of lomefloxacin (a) and tetracycline (b) at different reaction times