Experimental Section

Materials:

Ferrocene ($Fe(C_5H_5)_2$, ≥98%), hydrogen peroxide (H_2O_2, 30%), acetone (C_3H_6O) (≥99%), silver nitrate ($AgNO_3$), palladium chloride ($PdCl_2$) and dimethyl formamide (DMF) were of analytic grade from the Shanghai Chemical Factory, China. All chemicals were used as received without further purification.

Synthesis of Ag/Pd-magnetic hybrid nanoparticles

Intrinsically magnetic nanoclusters were prepared following the previously reported method by our group.[38] The magnetic nanoclusters were dissolved in DMF solvent and formed the DMF suspension (0.01 mmol/mL). Then, certain volume of silver nitrate solution (0.1 mmol/mL) dissolved in DMF and magnetic nanocluters suspension (10 mL) were transferred to the three-necked bottle and ensure the 35 mL solution volume by adding DMF solvent into the above mixture solution. After that, the precursor solution was heated to and maintained at 90 °C under the stir condition with a magnetic stirring apparatus. After 18 h, the reaction system was cooled naturally to room temperature. The products from the three-necked bottle were magnetized for 10 min by a magnet with 0.20 T, and the supernatant was discarded under a magnetic field. The precipitates were then washed three times with DMF to remove Ag without deposited on the surface of magnetic nanoclusters. Finally, the black products were dried at room temperature in a vacuum oven. In the above reaction system, by changing the molar ratio between $AgNO_3$ and magnetic nanoclusters, the concentration of reactants and reaction time, the size and quantity of Ag deposited on the surface of magnetic nanoparticles can be tuned. The synthesis process of Pd-magnetic hybrid nanoparticles is same with the above description.

Sample Characterization:

Surface charge was measured using Particles Analyzer (Delsa Nano C) from Beckman Coulter. The powder X-ray diffraction (XRD) patterns were collected on a Japan Rigaku D/MAX-γA X-ray diffractometer equipped

with Cu Kα radiation (λ = 1.54178 Å) over the 2θ range of 10–70°. Transmission electron microscopy (TEM) images were obtained on Hitachi H-800 transmission electron microscope, using an accelerating voltage of 200kV. High-resolution transmission electron microscopy (HRTEM) images were taken on a JEOL-2010 transmission electron microscope, which was operated at 200 kV. Energy-dispersive X-ray (EDX) analysis was obtained with an EDAX detector installed on the same HRTEM. A superconducting quantum interference device (SQUID) magnetometer (Quantum Design MPMS XL-7) was used to measure the magnetic properties of as-prepared samples. UV-vis spectra were recorded on UV-2501PC/2550 at room temperature (Shimadzu Corporation, Japan). The Raman spectrum was taken on a LABRAM-HR Confocal Laser Micro-Raman spectrometer using an Ar^+ laser with 514.5 nm at room temperature. The FT-IR spectrum was obtained using a Magna-IR 750 spectrometer in the range of 400-4000 cm^{-1} with a resolution of 4 cm^{-1}.

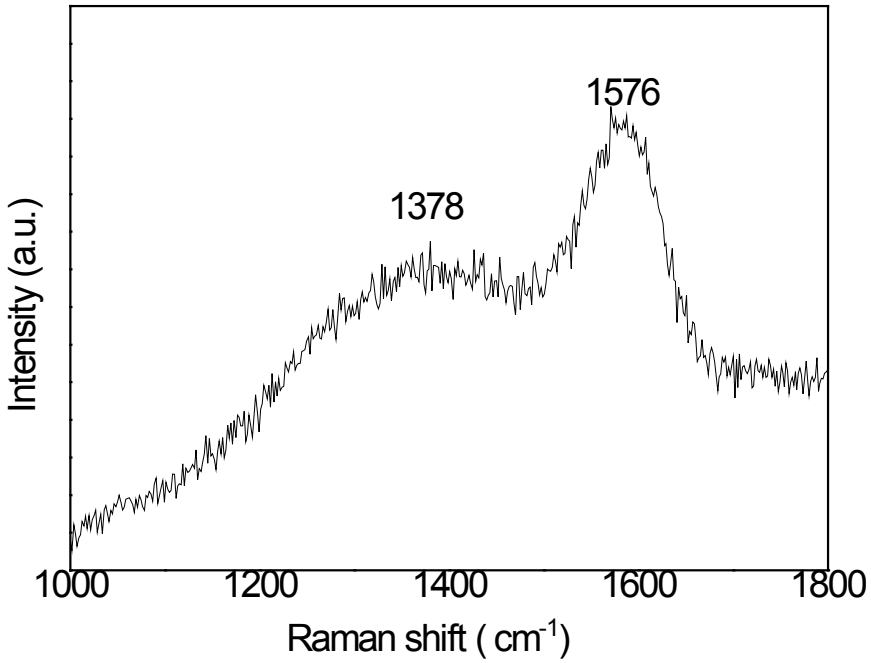

Figure S1. Raman spectrum of bifunctional Ag-iron oxide nanoparticles.

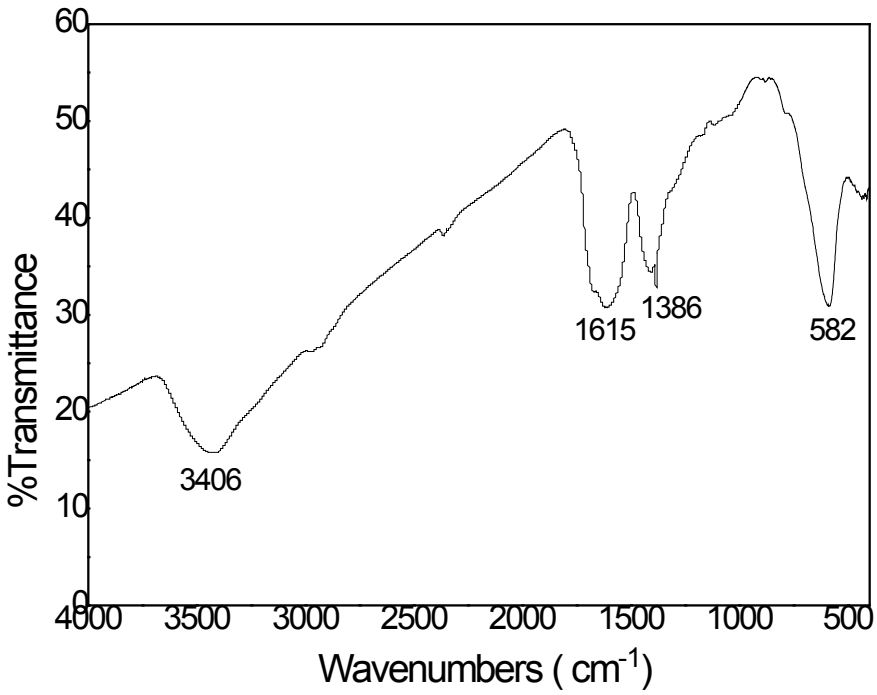

Figure S2. FT-IR spectrum of bifunctional Ag-iron oxide nanoparticles.

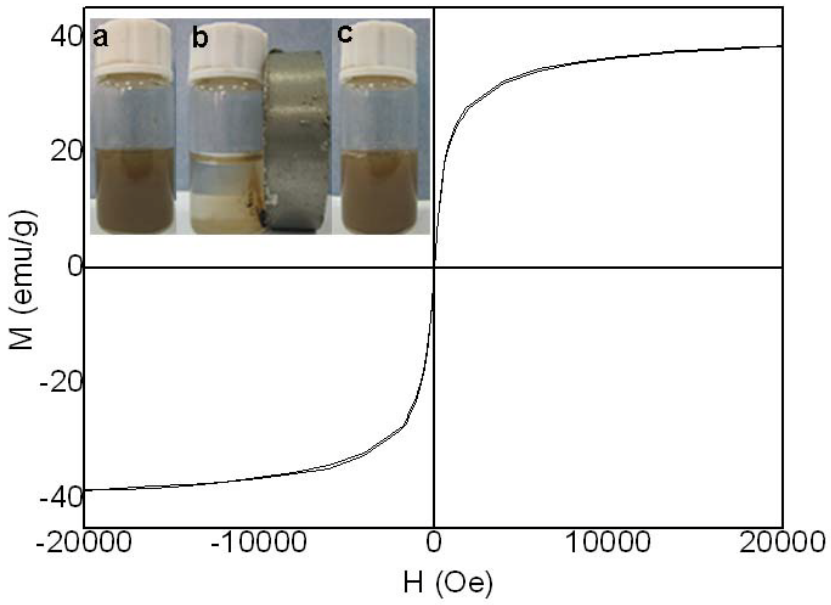

Figure S3. The hysteresis loop measured at room temperature for bifunctional hybrid nanoparticles. The inset (left) shows the respective expanded plots for field between −10 and 10 Oe. The inset (right) is photographs of an aqueous solution of bifunctional Ag-magnetic nanoparticles in a vial a) without magnetic field, b) with magnetic field for 1 min, and c) after the magnetic field is removed.

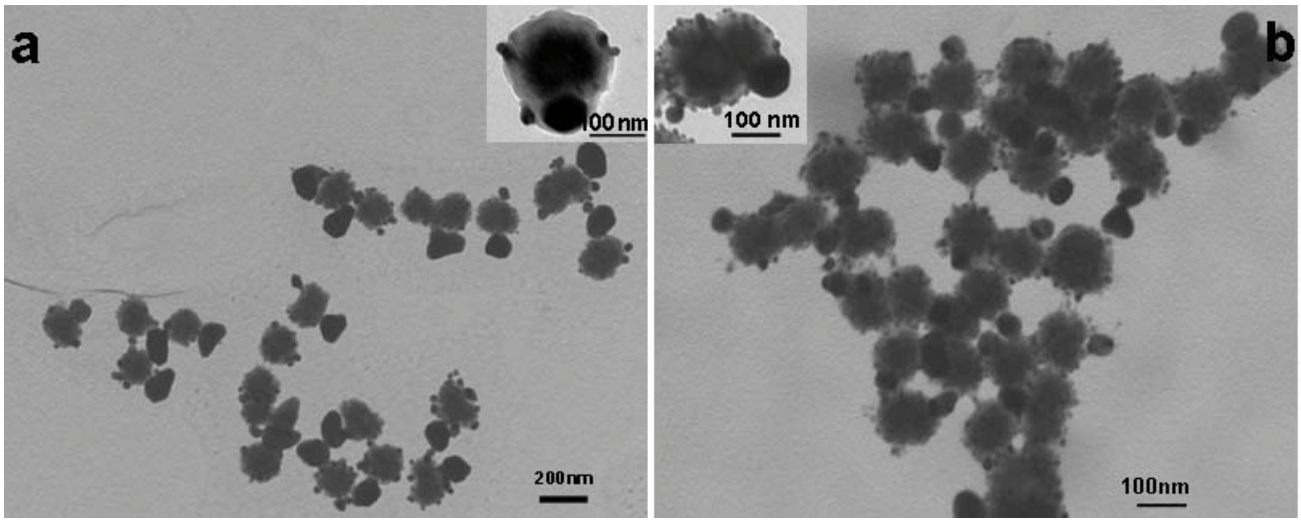

Figure S4. TEM images of bifunctional Ag-iron oxide nanoparticles synthesized under the different concentration with the molar ratio (1:1) between Ag^{+} and magnetic nanoclusters. (a) 2 times; (b) 5 times.