Electronic Supplementary Information

Monocrystalline mesoporous metal oxide with perovskite structure: a facile solid-state transformation of coordination polymer

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Experimental sections

$Bi[Fe(CN)_6]•4H_2O$ synthesis and calcination progress

0.6 mmol $Bi(NO_3)_3·4H_2O$ was dissolved in a 20 ml of 0.4 M HNO_3 solution which containing 600 mg Sc and 300 mg PVP, while 0.6 mmol $K_3[Fe(CN)_6]$ was dissolved in 20 ml of 0.4 M HNO_3 solution. Then, the two kinds of solutions were mixed with magnetic stirring for 1 min at room temperature. After standing in oven at 40 °C for 9 hours, the precipitation was washed for several times with deionized water and alcohol alternately. And then, the sample was dried in air for several hours. The $Bi[Fe(CN)_6]·4H_2O$ was calcined at 400 °C for 1 h in air atmosphere at a heating rate of 3 $^{o}C·min^{-1}$ from room temperature. After the sample was cooled to room temperature, the decomposition product was collected for the characterization.

Photocatalytic experiment

The photocatalytic activity was evaluated by the degradation of Rh B in aqueous solution under visible-light irradiation using a 40 W daylight lamp. In the experiment, aqueous suspensions of 50 mL Rh B with the concentration of 30 mg/L and 50 mg $BiFeO_3$ sample were placed in a reactor by stirring continuously with a magnetic stirrer for 30 min. Before the experiment began, 1 ml H_2O_2 was added in. Every 30 min, 1 mL of solution was taken from the beaker, diluted to 10 mL and then centrifuged. The degradation of Rh B was evaluated by testing the intensity of absorption peak of Rh B (558 nm) in the supernatant relative to its initial intensity (C/C_0) by spectrophotometer.

Characterizations

The phase compositions of the prepared samples were monitored by X-ray diffraction (XRD) using an X'Pert-Pro MPD diffractometer with Cu-Kα radiation and conventional θ-2θ geometry. The scanning electron microscopy (SEM) results were recorded on a Hitachi S-4800 field emission scanning electron microscope. A JEOL JEM-2100F transmission electron microscope operating at a 200 kV accelerating voltage was used for transmission electron microscopy (TEM) and high-resolution TEM (HRTEM) images. The Fourier-transform infrared (FT-IR) spectrum was measured at wavenumbers ranging from 400 cm^{-1} to 4000 cm^{-1} using a Nicolet Nexus 670 FT-IR spectrophotometer. The transmission ^{57}Fe Mössbauer spectrum was collected using a Mössbauer spectrometer in a constant acceleration mode with a ^{57}Co (Pd) source. The porosity of the calcined sample was determined by N_2 adsorption using an ASAP-2000 surface area analyzer. The magnetic property of the $BiFeO_3$ was studied with a vibrating sample magnetometer (VSM) (LakeShore 736) at room temperature. UV-Visible absorption spectra were measured using a UV-2802S spectrophotometer.

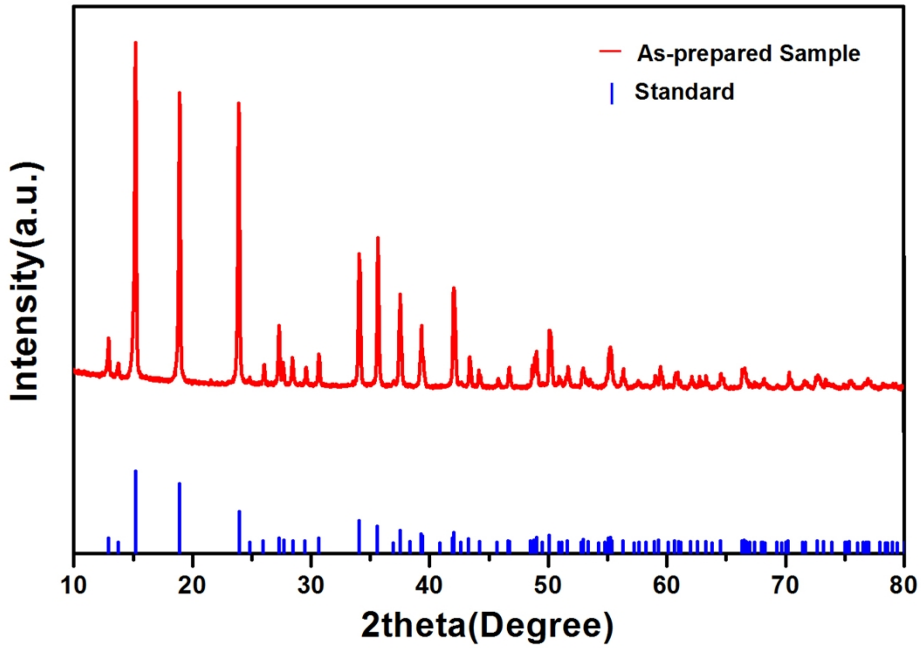

Fig. S1 XRD pattern of $Bi[Fe(CN)_6]\cdot 4H_2O$.

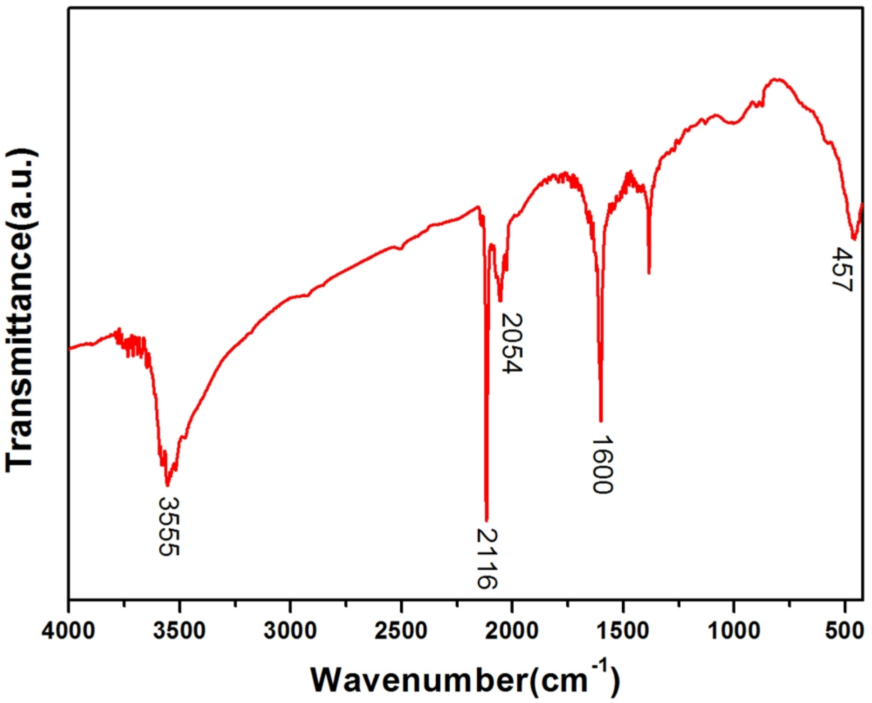

Fig. S2 FT-IR spectrum of Bi[Fe(CN)$_6$]•4H$_2$O.

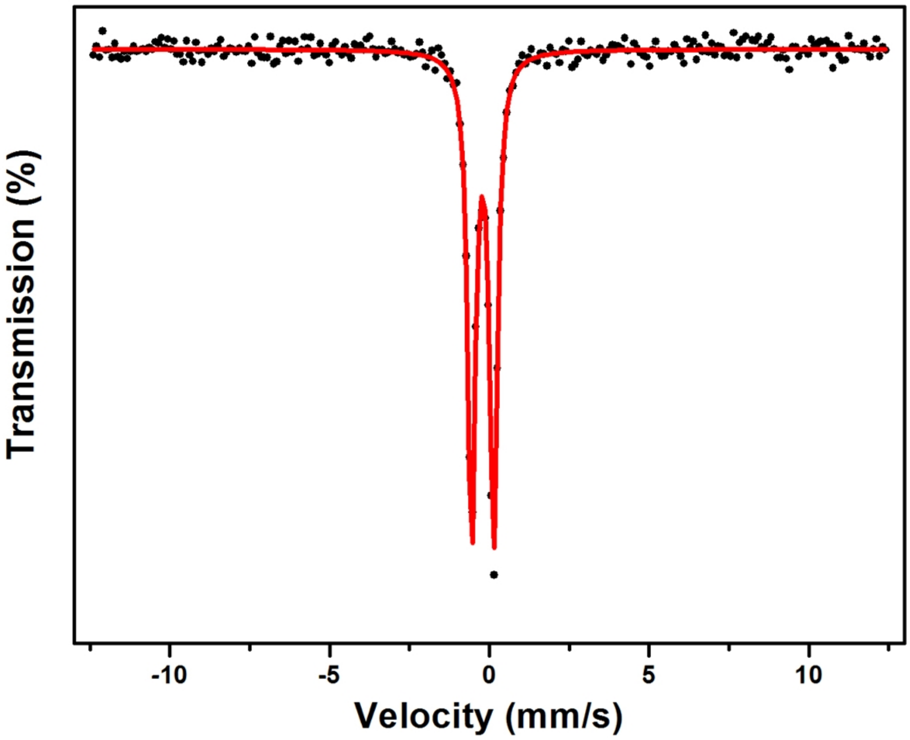

Fig. S3 Room temperature Mössbauer spectrum of Bi[Fe(CN)$_6$]•4H$_2$O.

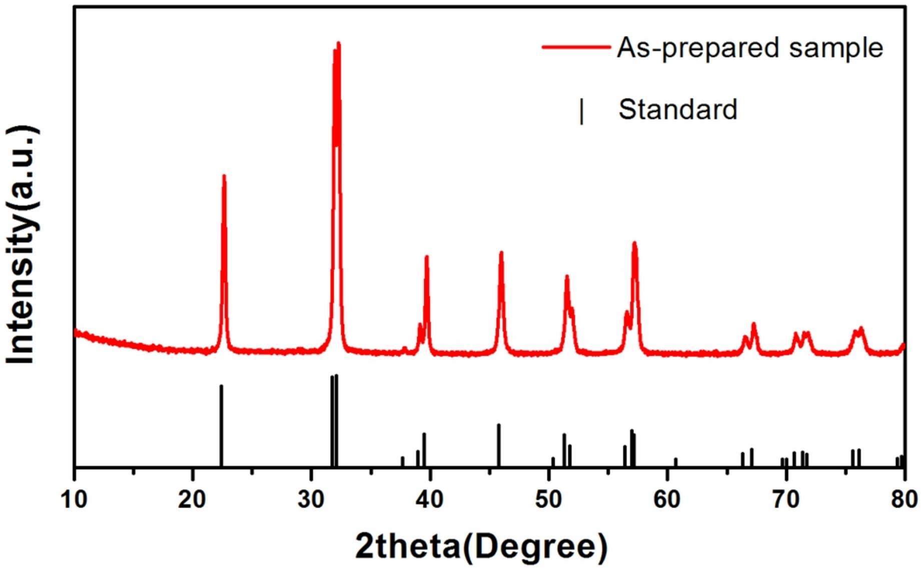

Fig. S4 XRD pattern of $BiFeO_3$.

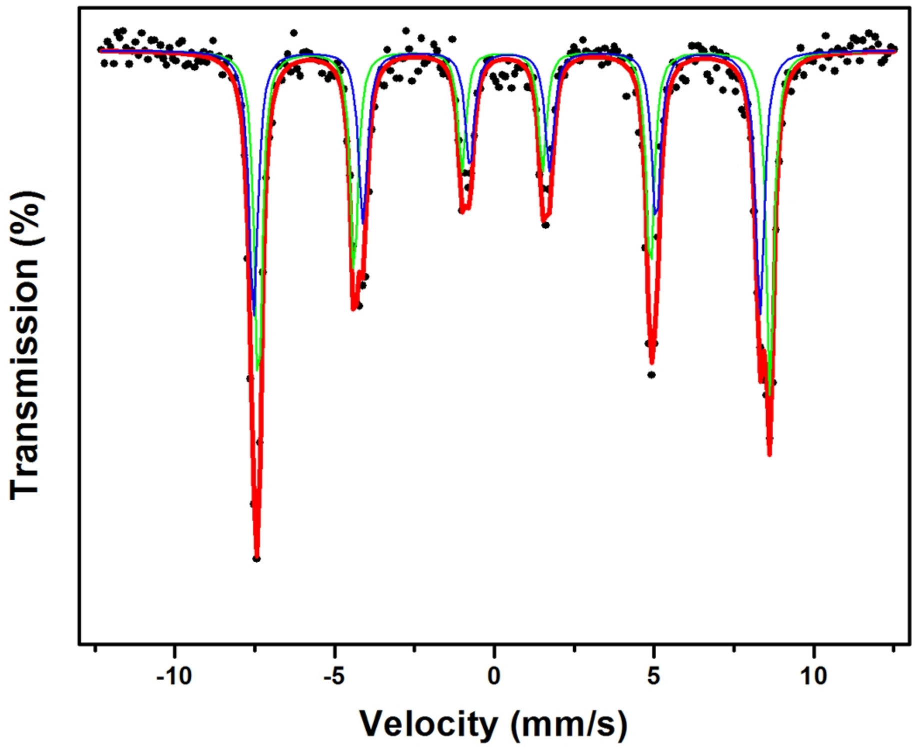

Fig. S5 Room temperature Mössbauer spectrum of $BiFeO_3$.

Sample	Sub-spectra	H_{hf} (T)	I.S.(mm/s)	Q.S.(mm/s)	Area
$BiFeO_3$	Sextet1	496.11	0.44	-0.37	0.523
	Sextet2	490.9	0.43	0.09	0.477

Table S1 Fitting parameters of the Mössbauer spectrum of $BiFeO_3$.

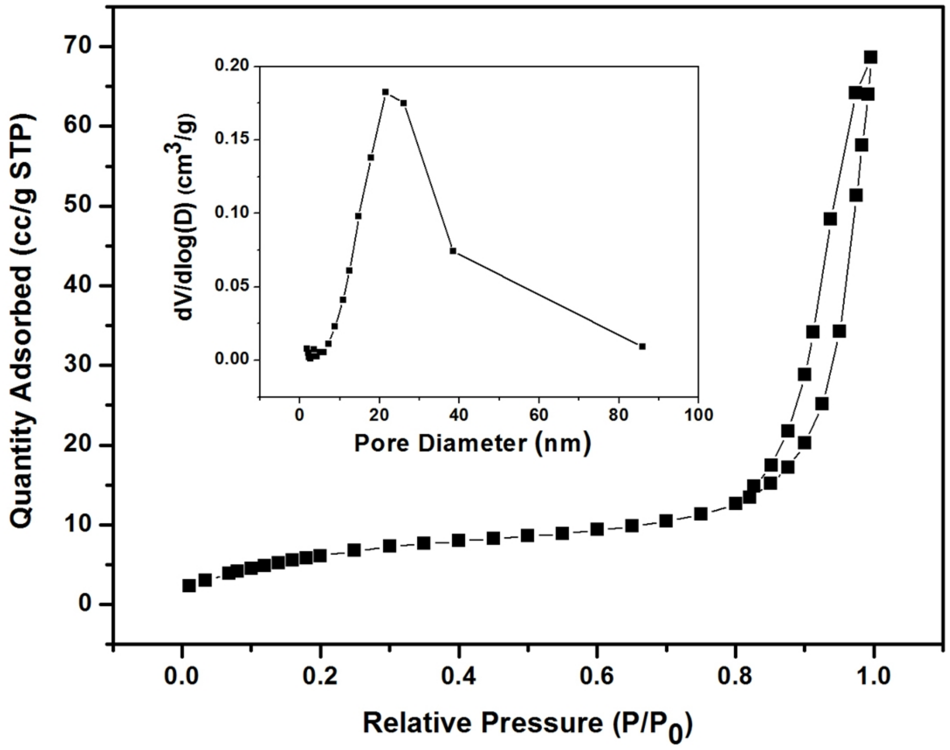

Fig. S6 **Nitrogen adsorption-desorption isotherm of the BiFeO$_3$ products, inset displays the pore size distribution curve of the products.**

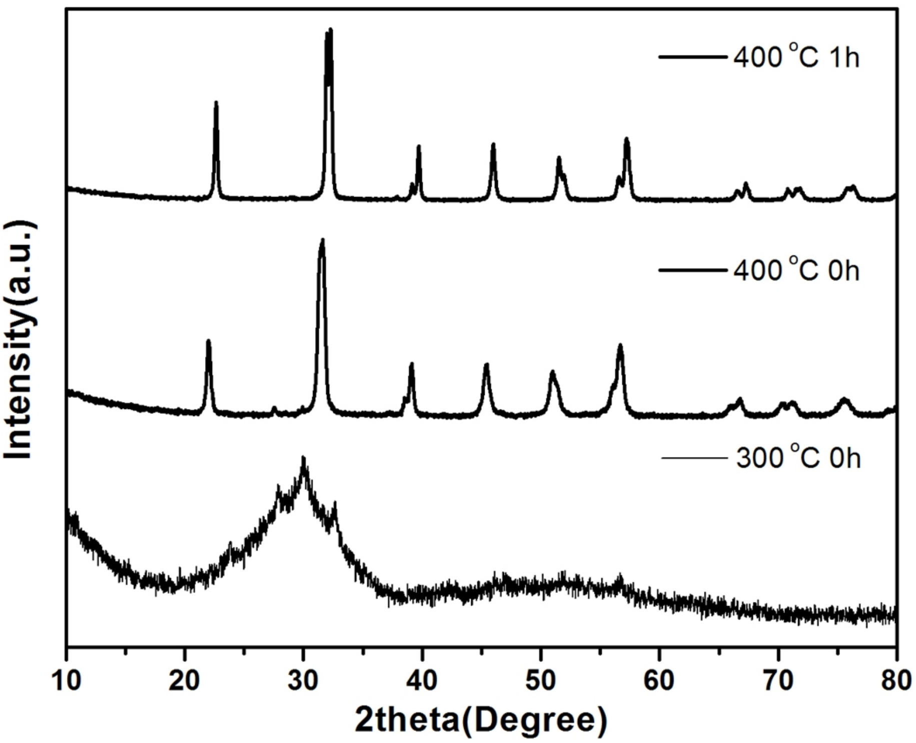

Fig. S7 XRD pattern of products at different stages in calcining process.

References	Synthesis techniques	Calcination temperature	Impurity Phase	Crystalline form
[a]	Solid-state reaction	800 ^oC, 5 h	$Bi_{25}FeO_{39}$, $Bi_2Fe_4O_9$	Polycrystalline
[b]	Rapid liquid sintering	880 ^oC, 30 min	Fe_2O_3	Polycrystalline
[c]	Ball Milling, solid-state reaction	830 ^oC, 3 h	Pure	Polycrystalline
[d]	Rapid sintering	800 ^oC, 20 min	Pure	Single-Crystalline
[e]	Molten salt method	750 ^oC, 2 h	$Bi_2Fe_4O_9$	Polycrystalline
[f]	Rapid liquid sintering	880 ^oC, 7.5 min	Pure	Polycrystalline

Table S2 The different synthesis methods and calcination requirement from Ref. 15.