Electronic Supplementary Information

High Surface Area Ordered Mesoporous BiFeO₃ Semiconductor with Efficient Water Oxidation Activity

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**Fig. S1** XRD pattern of mesostructured frameworks casted from mesoporous CMK-3 carbon, (a) without using tartaric acid along with the Bi(NO$_3$)$_3$ and Fe(NO$_3$)$_3$ compounds and (b) using tartaric acid at a 0.5:1 molar ratio with respect to metal ions. The product in (b) is composed of crystalline Bi$_2$O$_3$, Bi$_2$Fe$_4$O$_9$ and BiFeO$_3$. 
Fig. S2 (a) Nitrogen adsorption and desorption isotherms at 77 K and (b) the corresponding NLDFT pore size distribution for mesoporous CMK-3 carbon, indicating a mesopore size of 3.2 nm. Analysis of the adsorption data with the BET method gives surface area of 632 m$^2$g$^{-1}$ and total pore volume of 0.73 cm$^3$g$^{-1}$. Given an estimation of the mesopore diameter ($D_p$) at 3.2 nm and the unit cell size ($a_0$) at 9.8 nm, the pore wall thickness (WT) is about 6.6 nm, according to the equation WT=$a_0$–$D_p$. 
Fig. S3 Low-angle XRD pattern of mesoporous SBA-15 silica. The indexing of the Bragg diffractions is consisted with a hexagonal $p6mm$ unit cell with lattice parameter \(a_0=10.7\) nm.
Fig. S4 (a) Nitrogen adsorption and desorption isotherms at 77 K and (b) the corresponding NLDFT pore size distribution for mesoporous SBA-15 silica, indicating a mesopore size of 7.8 nm. Analysis of the adsorption data with the BET method gives surface area of 650 m$^2$g$^{-1}$ and total pore volume of 0.88 cm$^3$g$^{-1}$. Given an estimation of the mesopore diameter ($D_p$) at 7.4 nm and the unit cell size ($a_0$) at 10.7 nm (see Fig. S3), the pore wall thickness ($WT$) is about 3.3 nm, according to the equation $WT = a_0 - D_p$. 
Fig. S5 (a) M-H loops at different temperatures for mesostructured BiFeO$_3$ in the -50 to +50 kOe range. Fast saturation of the magnetization is observed. (b) Magnetization plotted as function of H/T in the very narrow range of -35 to +35 Oe for 40, 77, 100 and 200 K. The inset shows the temperature dependence of the coercivity normalized to the value at 5 K. Black points are the experimental data and red line is root square dependence of the coercivity ($H_C=1-(T/T_B)^{1/2}$) assuming blocking temperature $T_B = 95$ K.
Fig. S6 Typical EDS spectrum for mesoporous Au/BiFeO$_3$ photocatalyst. The EDS analysis indicates an average atomic ratio of Au/Bi/Fe ~0.8:49.7:49.5 that corresponds to a ~1 wt % Au loading.
Fig. S7 Typical TEM image of mesoporous Au/BiFeO₃ sample. The inset shows the HRTEM image of an individual Au nanoparticle. The measured $d$-spacing is around 2.4 Å which is in consistent with the Au (111) crystal plane.
Fig. S8 (a) Nitrogen adsorption and desorption isotherms at 77 K and (b) the corresponding NLDFT pore size distribution for mesoporous Au/BiFeO$_3$ photocatalyst. Analysis of the adsorption data with the BET method gives surface area of 116 m$^2$ g$^{-1}$ and total pore volume of 0.10 cm$^3$ g$^{-1}$. The NLDFT analysis of the adsorption data indicates a mesopore size of 7.0 nm.
Fig. S9 UV-Vis/NIR absorption spectrum of mesoporous Au/BiFeO$_3$ heterostructure.
Fig. S10 Oxygen evolution profile for mesoporous Au/BiFeO$_3$ under visible light irradiation, showing an O$_2$ evolution rate of $\sim$120 µmol h$^{-1}$ g$^{-1}$.