Supporting Information

Synergetic Effect between Photocatalysis on TiO_2 and Solar Light Driven Thermocatalysis on MnO_x for Benzene Purification on MnO_x/TiO_2 Nano Composites

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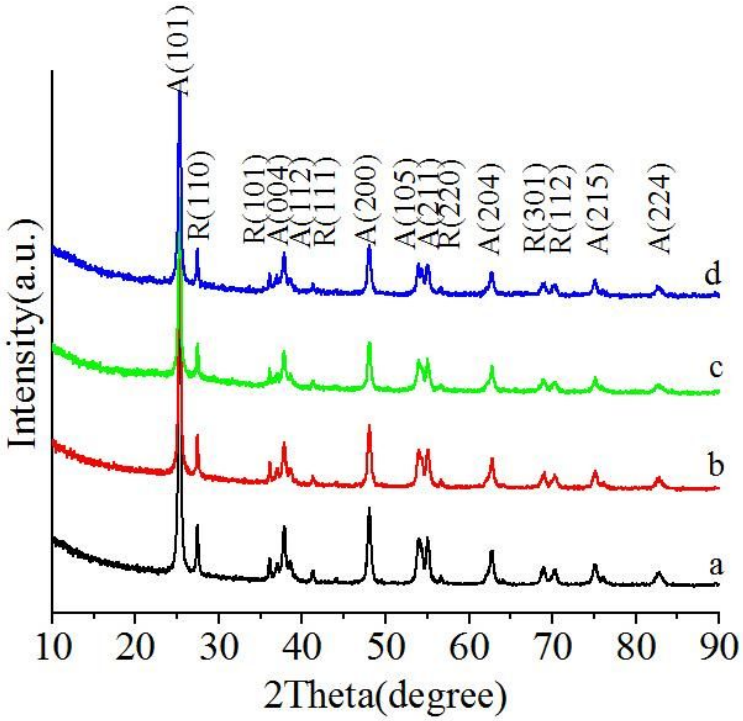

Figure S1. XRD patterns of TiO_2 (P25) (a), MnO_x/TiO_2-A (b), MnO_x/TiO_2-B (c), and MnO_x/TiO_2-C (d): A-anatase, R-rutile.

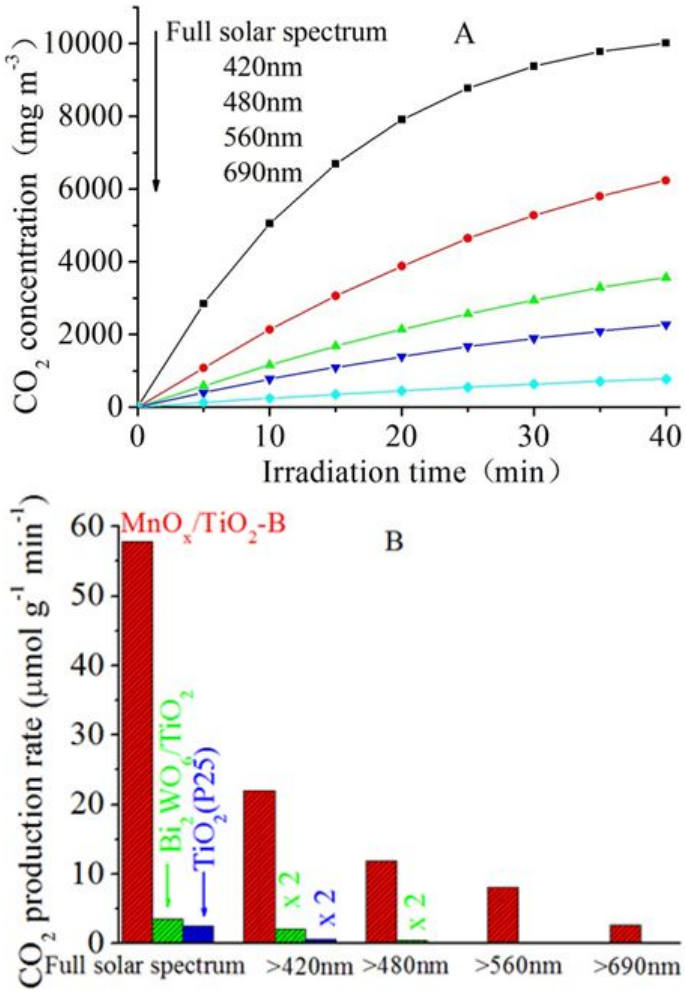

Figure S2. Time course of CO_2 concentration for benzene oxidation on the MnO_x/TiO_2-B (A), r_{CO2} (B) for benzene oxidation on MnO_x/TiO_2-B, TiO_2(P25), and Bi_2WO_6/TiO_2 under the full solar spectrum and visible-infrared irradiation by using different cut-off filters.

Under the visible-infrared irradiation above 420 nm, MnO_x/TiO_2-B exhibits efficient catalytic activity for benzene oxidation. In contrast, benzene is slowly oxidized on both TiO_2(P25) and Bi_2WO_6/TiO_2. r_{CO2} of MnO_x/TiO_2-B (21.93 μmol g^{-1} min^{-1}) is 75.8, 21.2 time higher than that of TiO_2(P25), Bi_2WO_6/TiO_2, respectively. Under the visible-infrared irradiation above 480 nm, MnO_x/TiO_2-B shows catalytic activity for benzene oxidation, and its r_{CO2} is 11.92 μmol g^{-1} min^{-1}. However, in this case, benzene cannot be oxidized to CO_2 on TiO_2(P25). Although benzene can be slowly oxidized to CO_2 on Bi_2WO_6/TiO_2, r_{CO2} of Bi_2WO_6/TiO_2 is very low (0.24 μmol g^{-1} min^{-1}), 49.0 times lower than that of MnO_x/TiO_2-B. Under the visible-infrared irradiation above 560 nm, MnO_x/TiO_2-B still exhibits catalytic activity for benzene oxidation, and its r_{CO2} is 8.03 μmol g^{-1} min^{-1}. In contrast, no CO_2 is detected for benzene oxidation on Bi_2WO_6/TiO_2, suggesting that benzene cannot be oxidized to CO_2 on Bi_2WO_6/TiO_2 in this case. Even under the visible-infrared irradiation above 690 nm, MnO_x/TiO_2-B shows catalytic activity for benzene oxidation with r_{CO2} of 2.64 μmol g^{-1} min^{-1}, which is comparable to that of Bi_2WO_6/TiO_2 with the full solar spectrum irradiation (r_{CO2} =3.53 μmol g^{-1} min^{-1}).

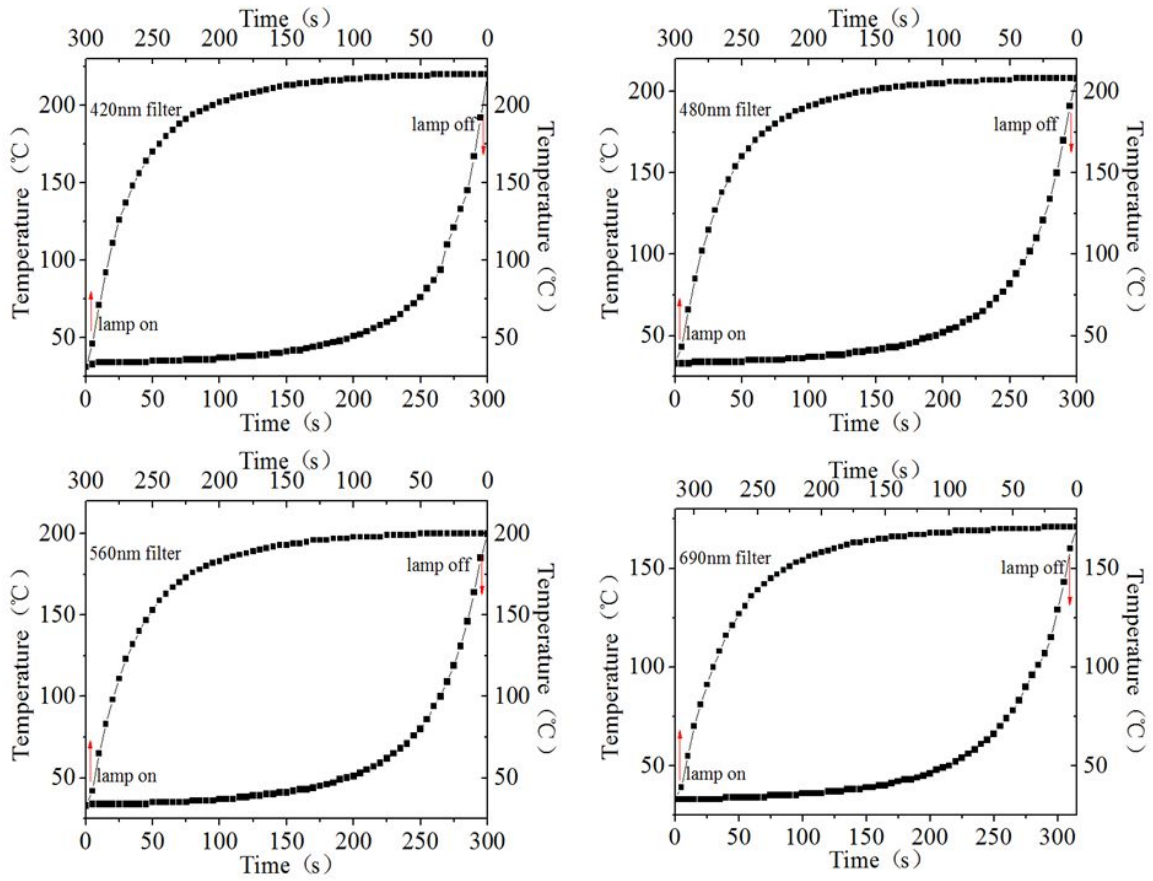

Figure S3. Temporal change of the temperature on MnO_x/TiO_2-B under the visible-infrared irradiation by using different cut-off filters and after switching off the Xe lamp.