Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Electronic Supporting Information

A Novel Heterogeneous Catalyst NH_2-MIL-88/$PMo_{10}V_2$ for Photocatalytic Activity Enhancement of Benzene Hydroxylation

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S9 The apparent quantum yield (AQY)

S10: Photo of the Photocatalytic instrument (PCX-50C)

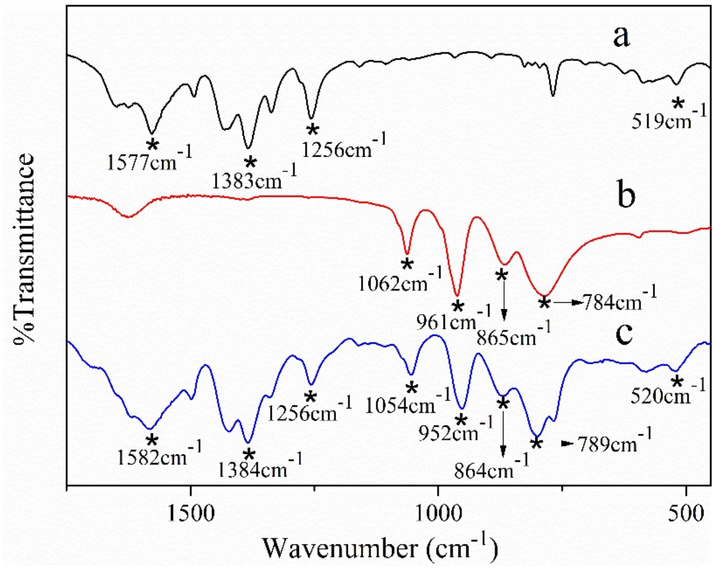

Fig S1. The infrared partial spectra of (a) NH_2-MIL-88, (b) $H_5PMo_{10}V_2O_{40}$ and (c) NH_2-MIL-88/$PMo_{10}V_2$-3

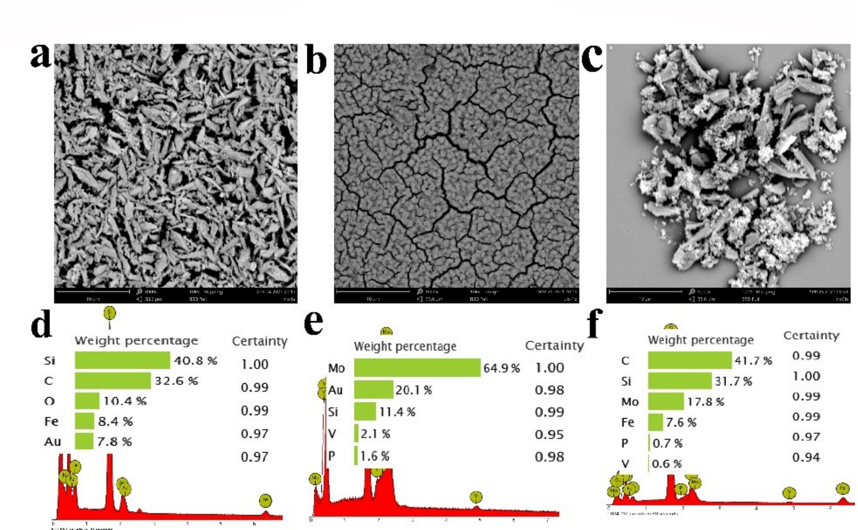

Figure S2 SEM images of the (a) NH_2-MIL-88, (b) $PMo_{10}V_2$ and (c) NH_2-MIL-88/$PMo_{10}V_2$-3, EDS mapping of (d) NH_2-MIL-88, (e) $PMo_{10}V_2$ and (f) NH_2-MIL-88/$PMo_{10}V_2$-3

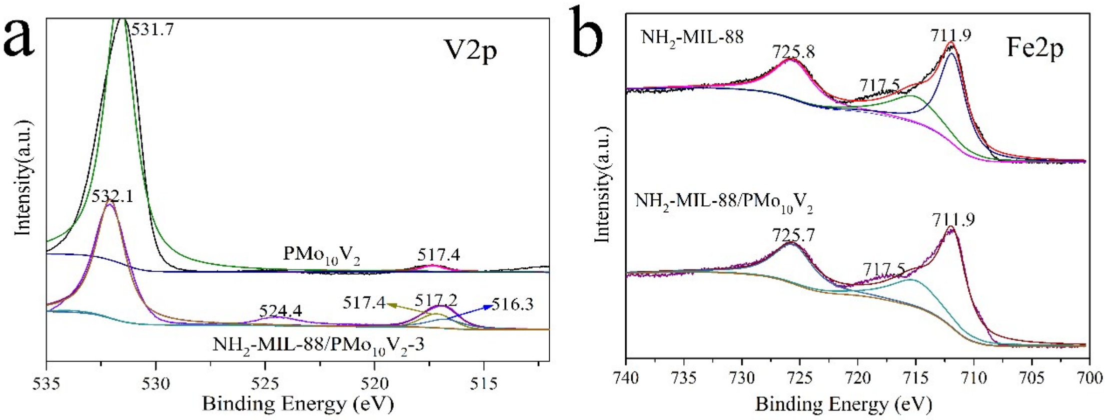

Figure S3 XPS spectra of the catalyst (a) V2p and (b) Fe2p

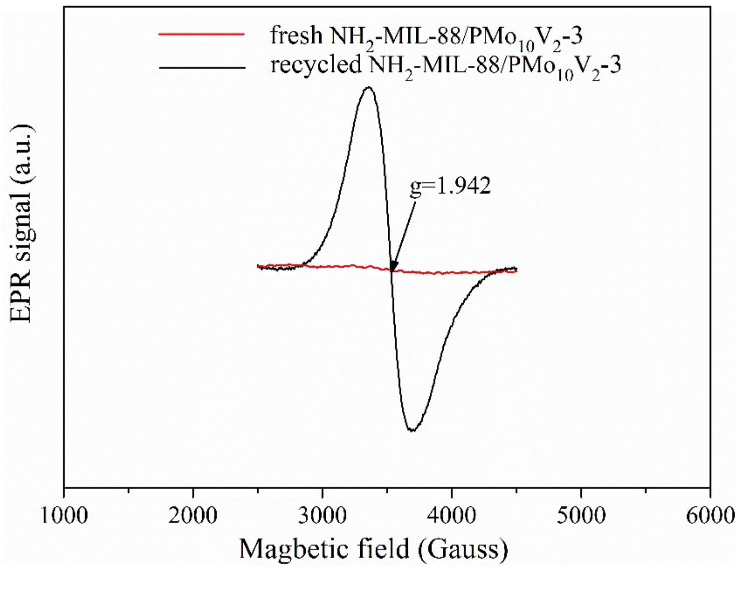

Figure S4 EPR spectra of fresh NH_2-MIL-88/$PMo_{10}V_2$-3 and recycled NH_2-MIL-88/$PMo_{10}V_2$-3

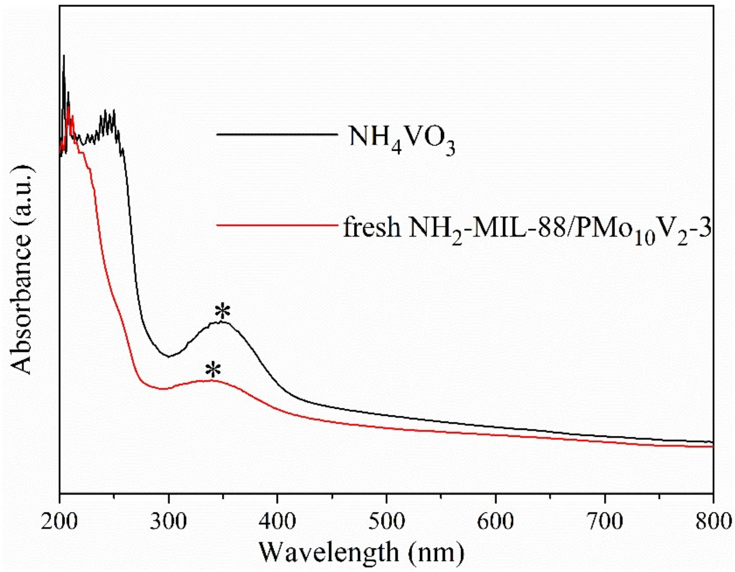

Fig S5 UV-vis spectra of the fresh NH_2-MIL-88/$PMo_{10}V_2$-3 catalyst and NH_4VO_3

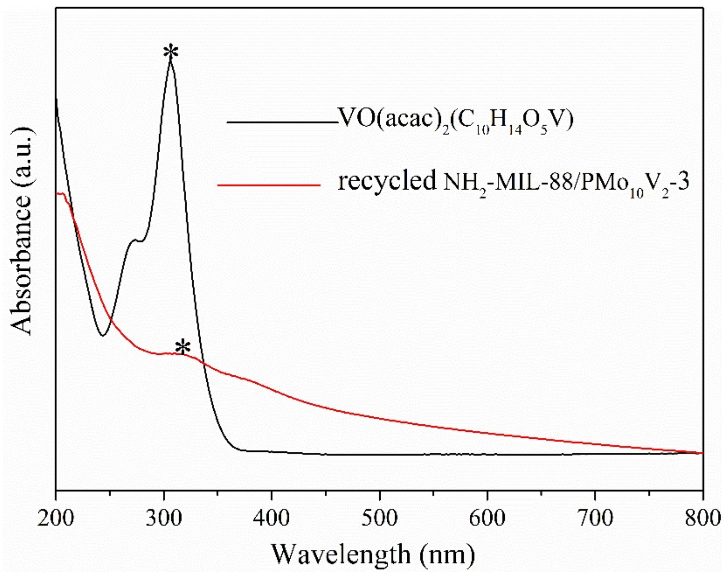

Fig S6 UV-vis spectra of the recovered NH_2-MIL-88/$PMo_{10}V_2$-3 catalyst and $VO(acac)_2$

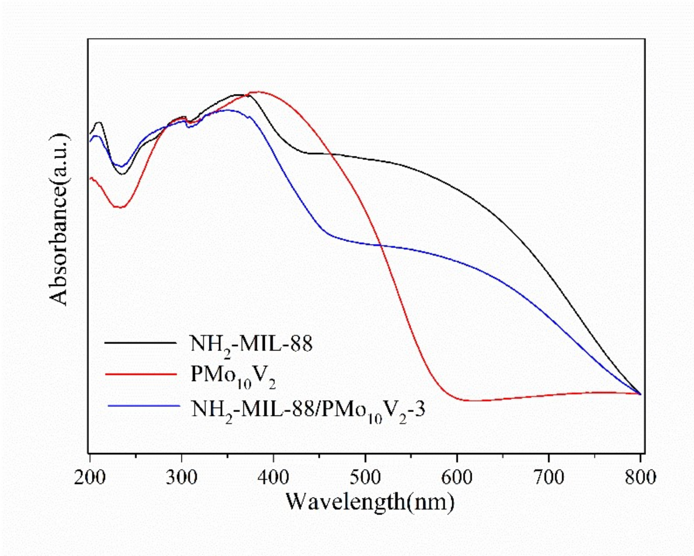

Figure S7 UV-Vis diffuse reflectance of the (a) NH_2-MIL-88, (b) $PMo_{10}V_2$ and (c) NH_2-MIL-88/$PMo_{10}V_2$-3

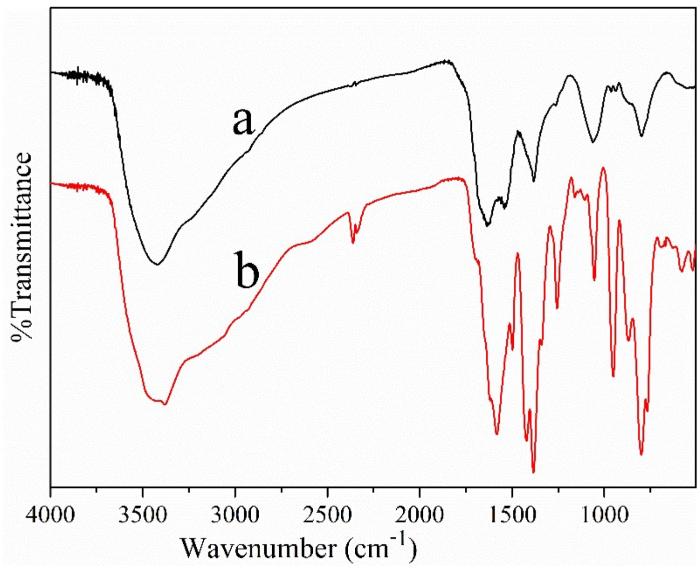

Fig S8. The infrared fractionated gain spectra of (a) recycled NH_2-MIL-88/$PMo_{10}V_2$-3 and (b) fresh NH_2-MIL-88/$PMo_{10}V_2$-3

Fig S9

Since the light source (white light and wavelength range from 320 nm to 780 nm) used in this experiment is fixed inside the PCX-50C instrument, the AQY can't be measured at a single wavelength. Hence, under optimal conditions, the Apparent Quantum Yield (AQY) of the photocatalytic hydroxylation of benzene to phenol at the minimum wavelength (λ=320 nm) and the maximum wavelength (λ=780 nm) was determined to be 3.55% and 1.45%, respectively according to the following equation, where R_1 (mol s^{-1}) is the hydroxylation of benzene to phenol rate in 3 h and R_2 (mol s^{-1}) is the rate of incident photon.

$$AQY\ (\%) = (R_1 / R_2) \times 100\%$$

As one electron produce one hydroxyl radical, hence one photon is required for this system. Assuming that all photons are absorbed by the catalyst, the resulting quantum yield can be calculated as the apparent quantum yield.

Fig S10

Photo of the Photocatalytic instrument (PCX-50C):