High efficient degradation of high-loaded phenol over Ru-Cu/Al_2O_3 catalyst at mild conditions

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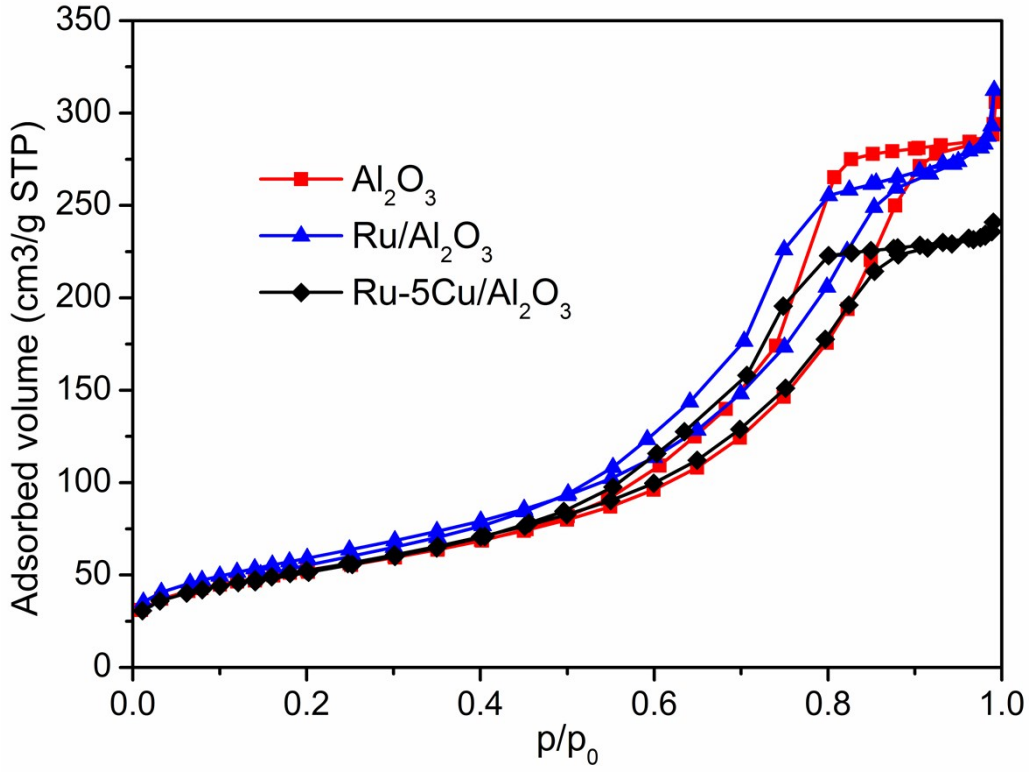

Fig. S1. N_2 adsorption-desorption isotherms for support and catalysts.

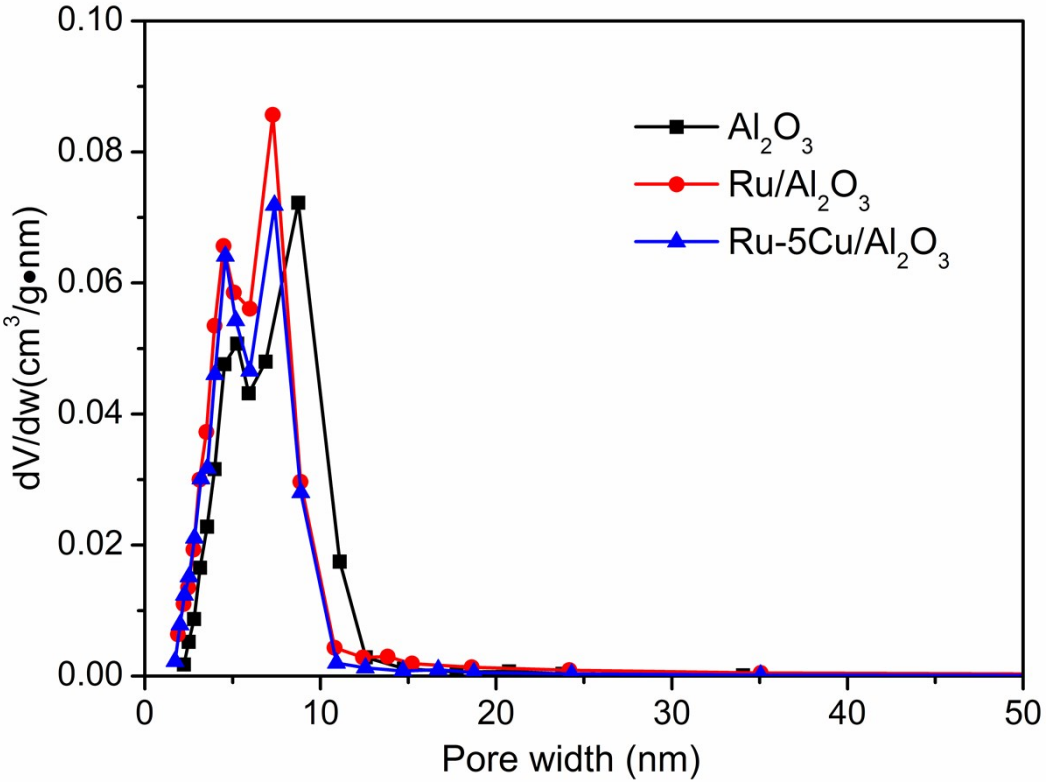

Fig. S2. Pore size distribution of support and catalysts derived from the desorption branch of the isotherm.

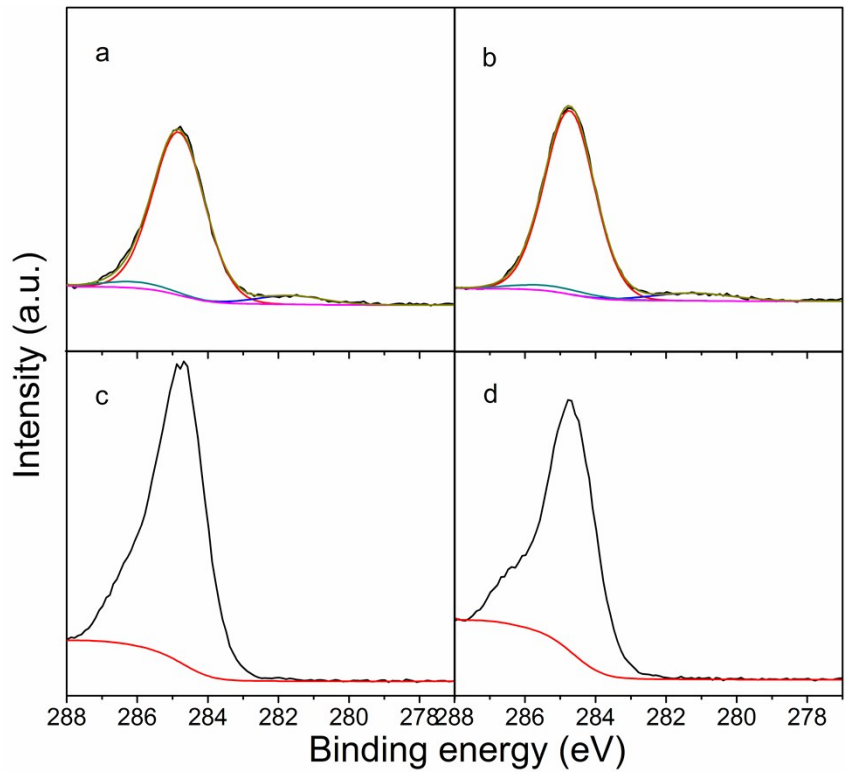

Fig. S3. Ru 3d spectra of different catalysts: (a) Ru/Al_2O_3; (b) $Ru\text{-}5Cu/Al_2O_3$; (c) used Ru/Al_2O_3; (d) used $Ru\text{-}5Cu/Al_2O_3$.

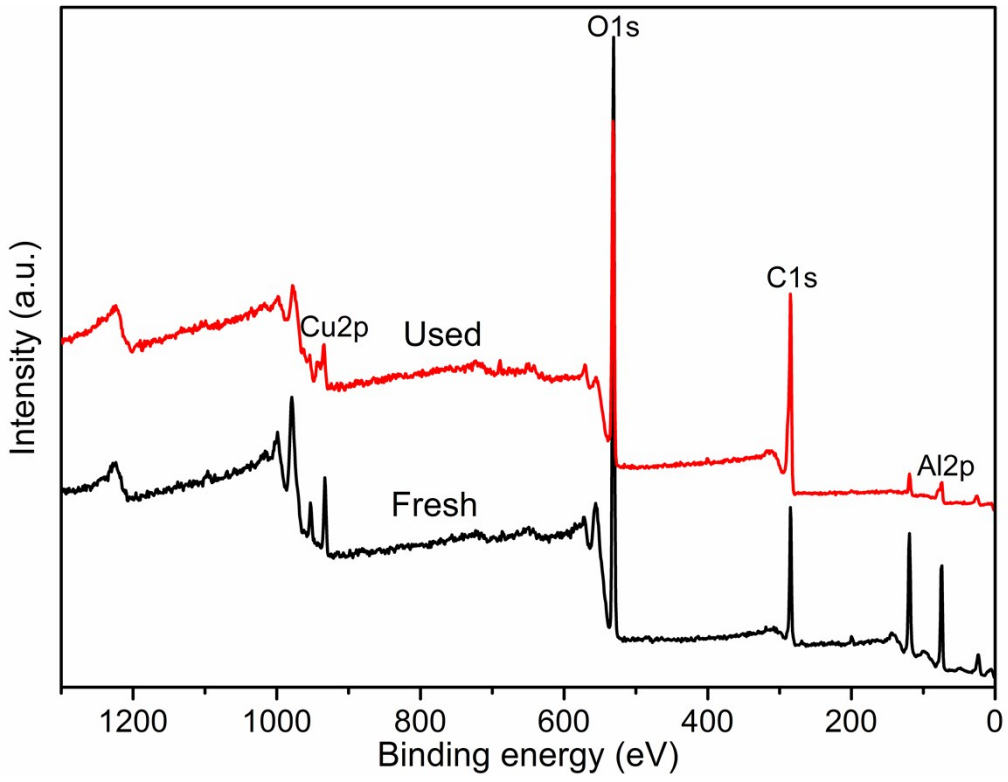

Fig. S4. XPS survey spectra of fresh and used catalyst.

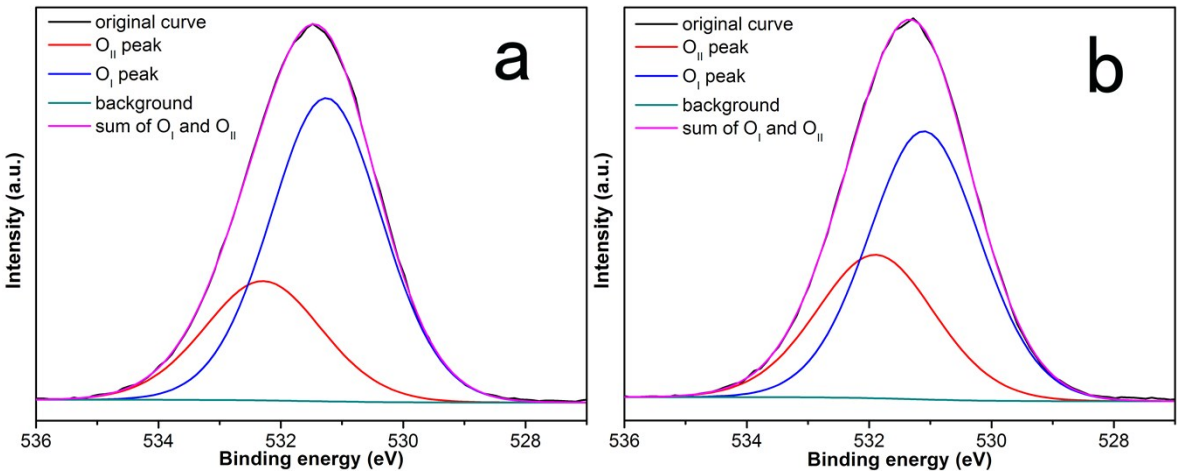

Fig. S5. XPS O1s spectra of (a) Ru/Al_2O_3 and (b) $Ru\text{-}5Cu/Al_2O_3$.

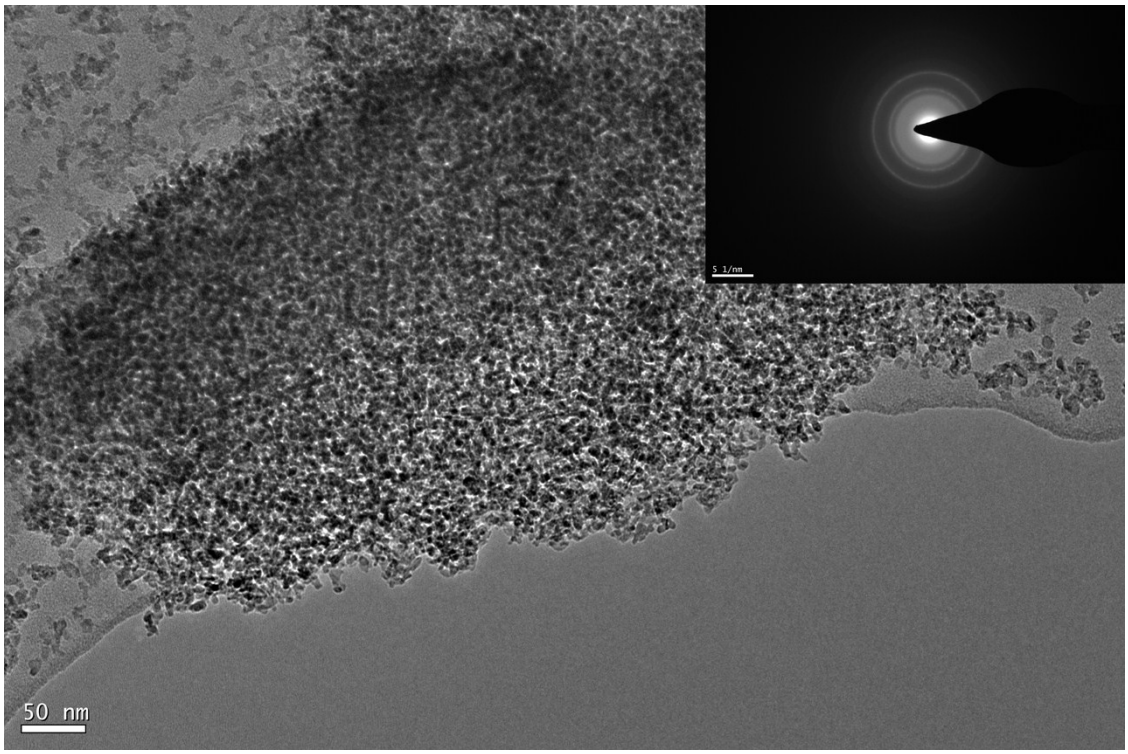

Fig. S6. TEM images of $Ru\text{-}5Cu/Al_2O_3$.

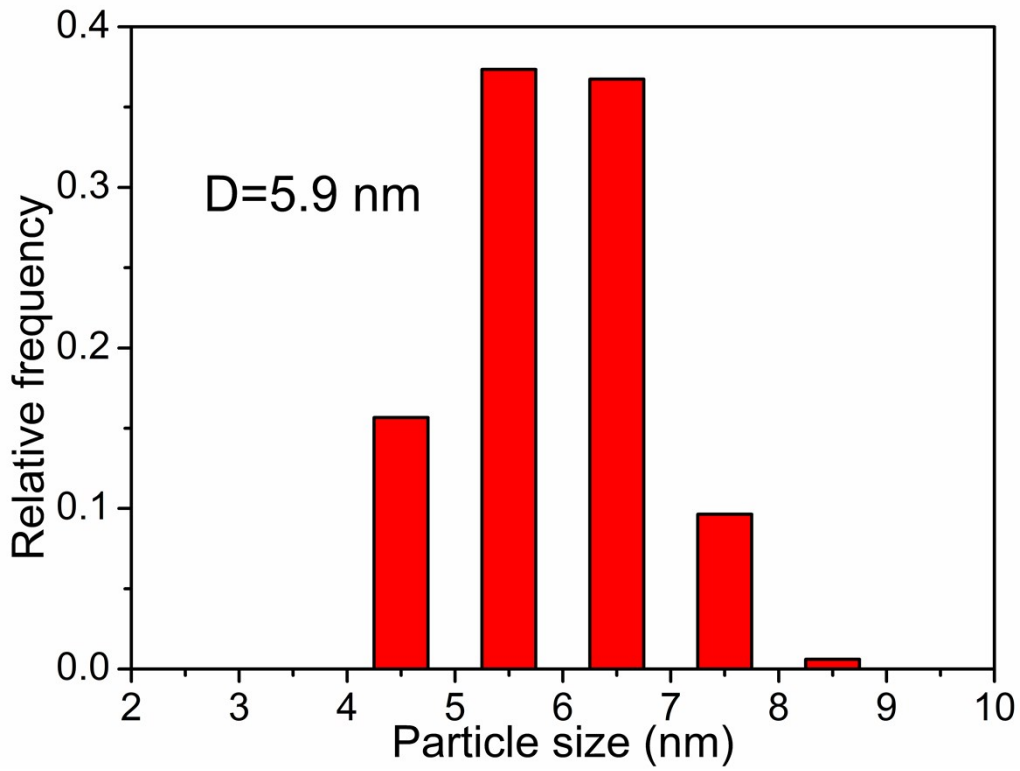

Fig. S7. Particle size distribution of Ru-5Cu/Al_2O_3.

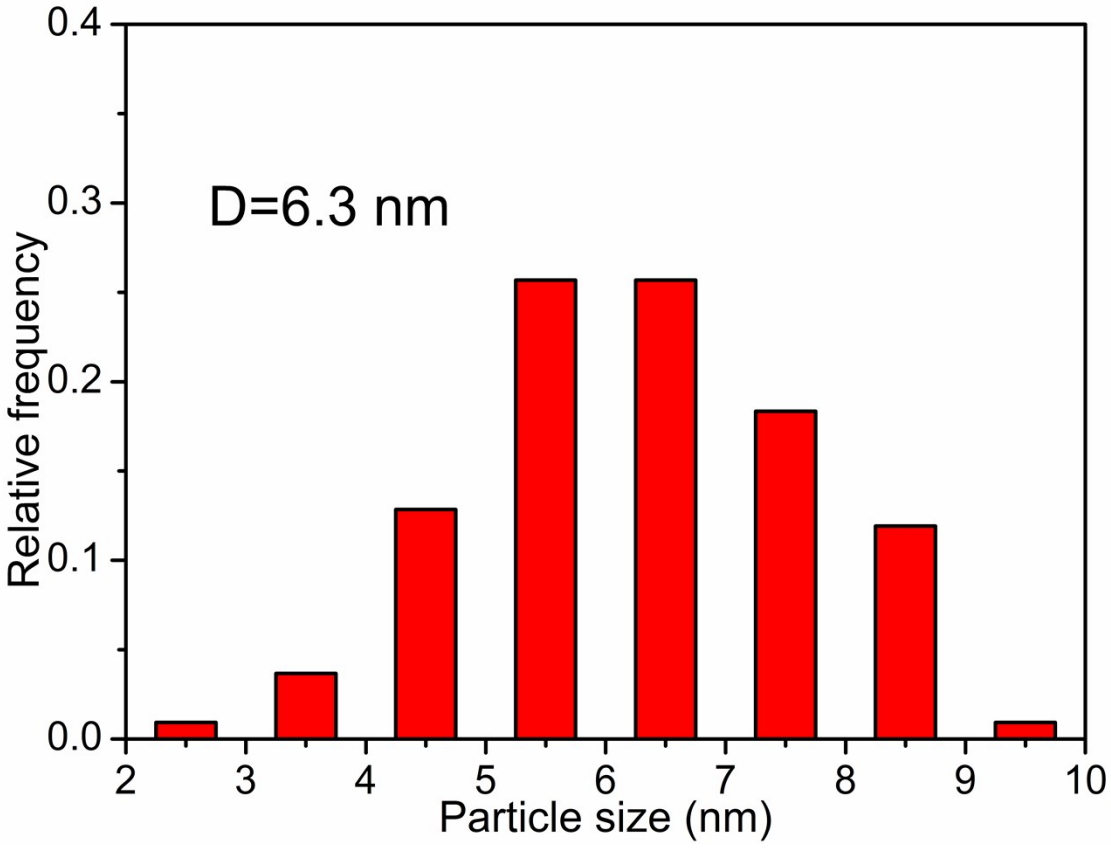

Fig. S8. Particle size distribution of Ru/Al_2O_3.

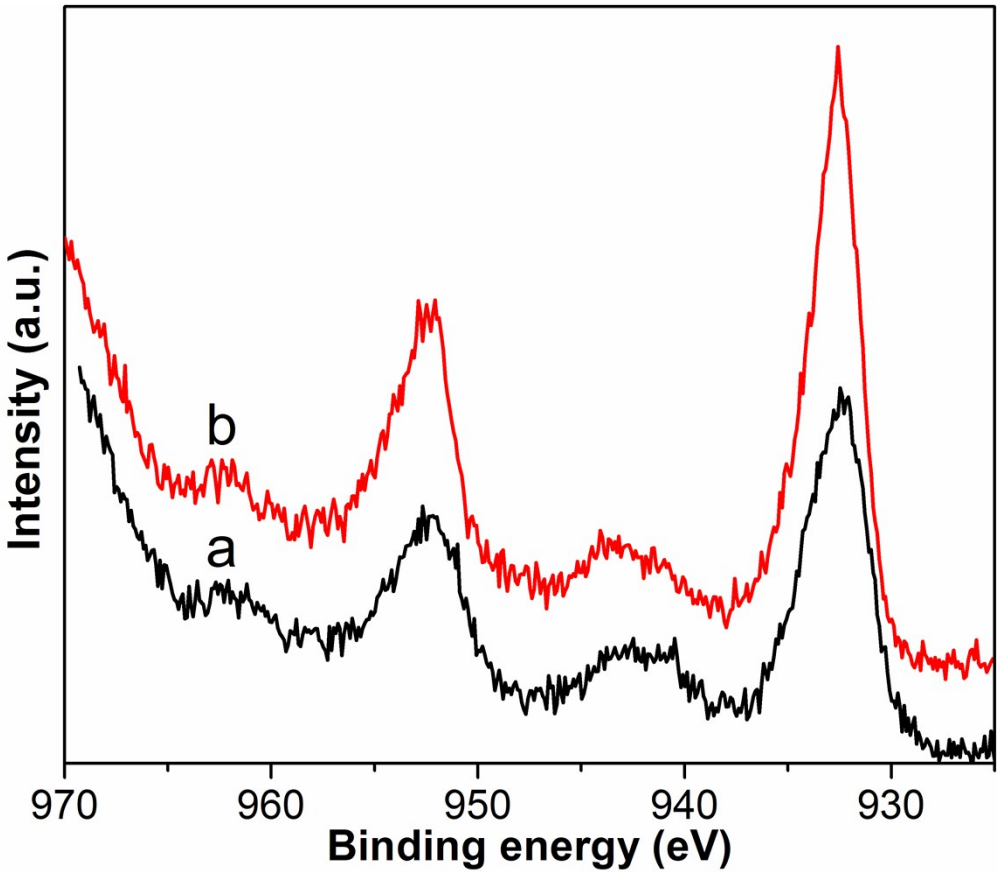

Fig. S9. Cu 2p XPS spectra of (a) used Ru-5Cu/Al_2O_3 after calcination under 500 °C and (b) used Ru-5Cu/Al_2O_3 after calcination under 500 °C and H_2 treatment (H_2 treatment conditions was the same as catalyst preparation).