Electronic Supplementary information

Gold nanoparticles supported on nanoscale amine-functionalized MIL-101(Cr) as a highly active catalyst for epoxidation of styrene

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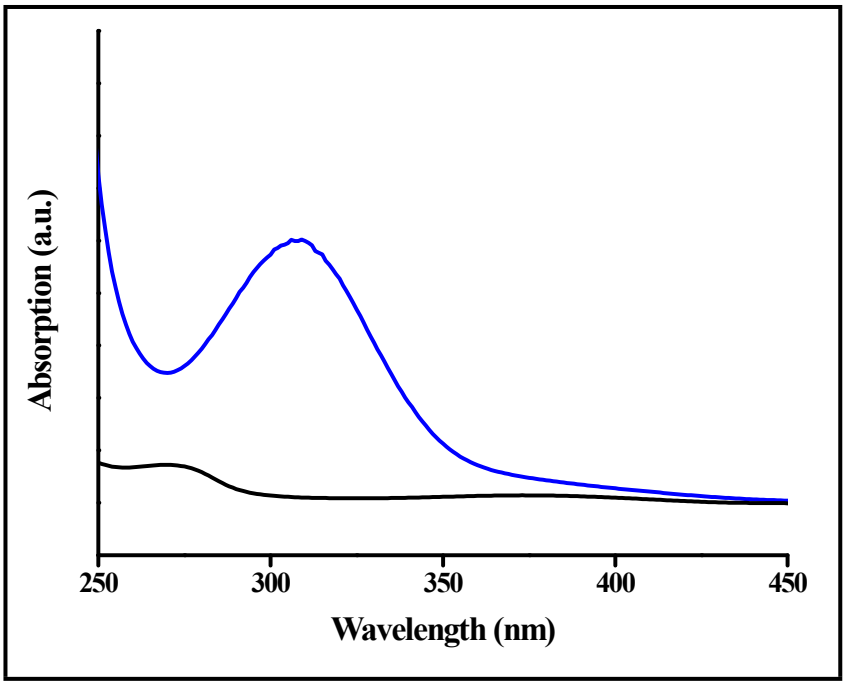

Fig S1 UV spectrum of $HAuCl_4$ before adsorption (blue) and after adsorption (black) on NH_2-MIL-101(Cr)

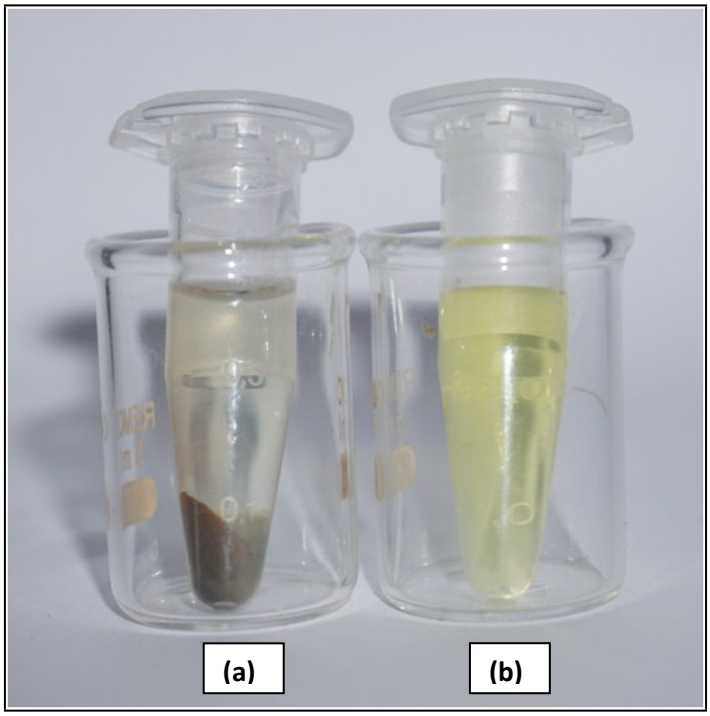

Fig S2 NH_2-MIL-101(Cr) for $HAuCl_4$ absorption (a) NH_2-MIL-101(Cr) was added to $HAuCl_4$ solution (centrifuged after 3h) and (b) $HAuCl_4$ solution.

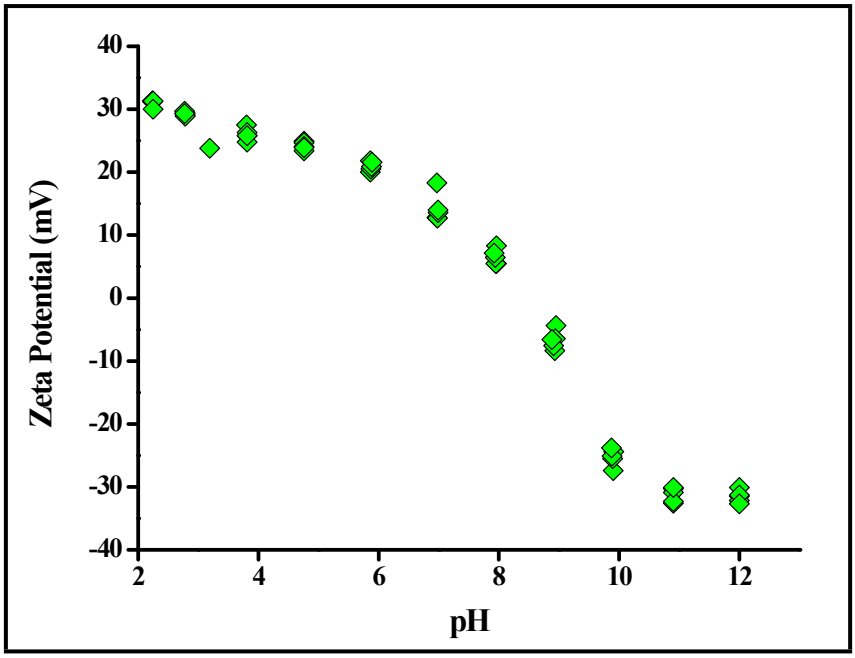

Fig S3 Zeta potential analysis of the support for determining IEP value.

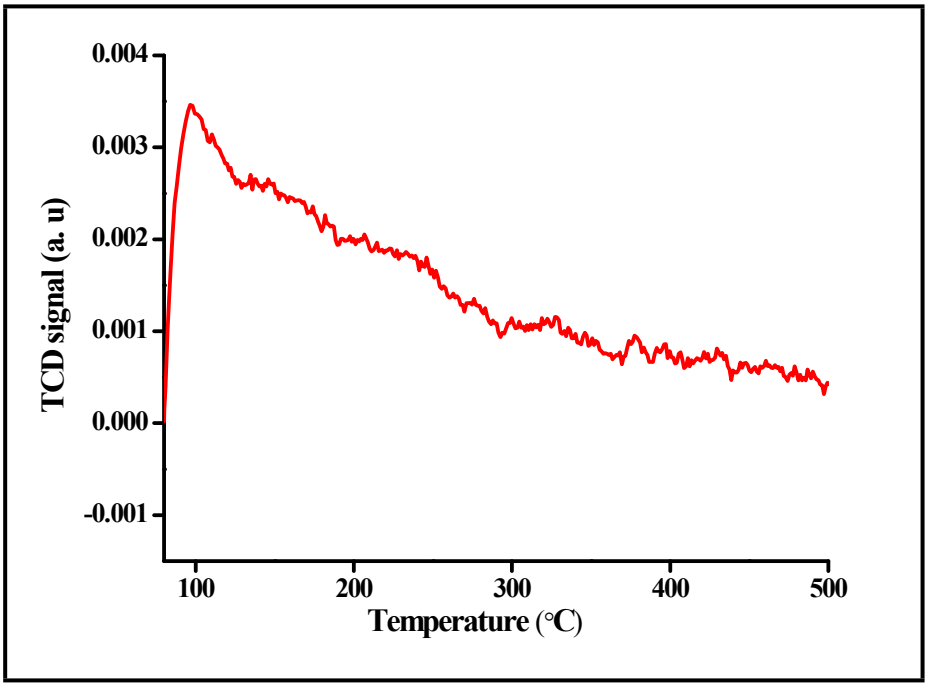

Fig S4 CO_2-TPD profile of NH_2-MIL-101(Cr)

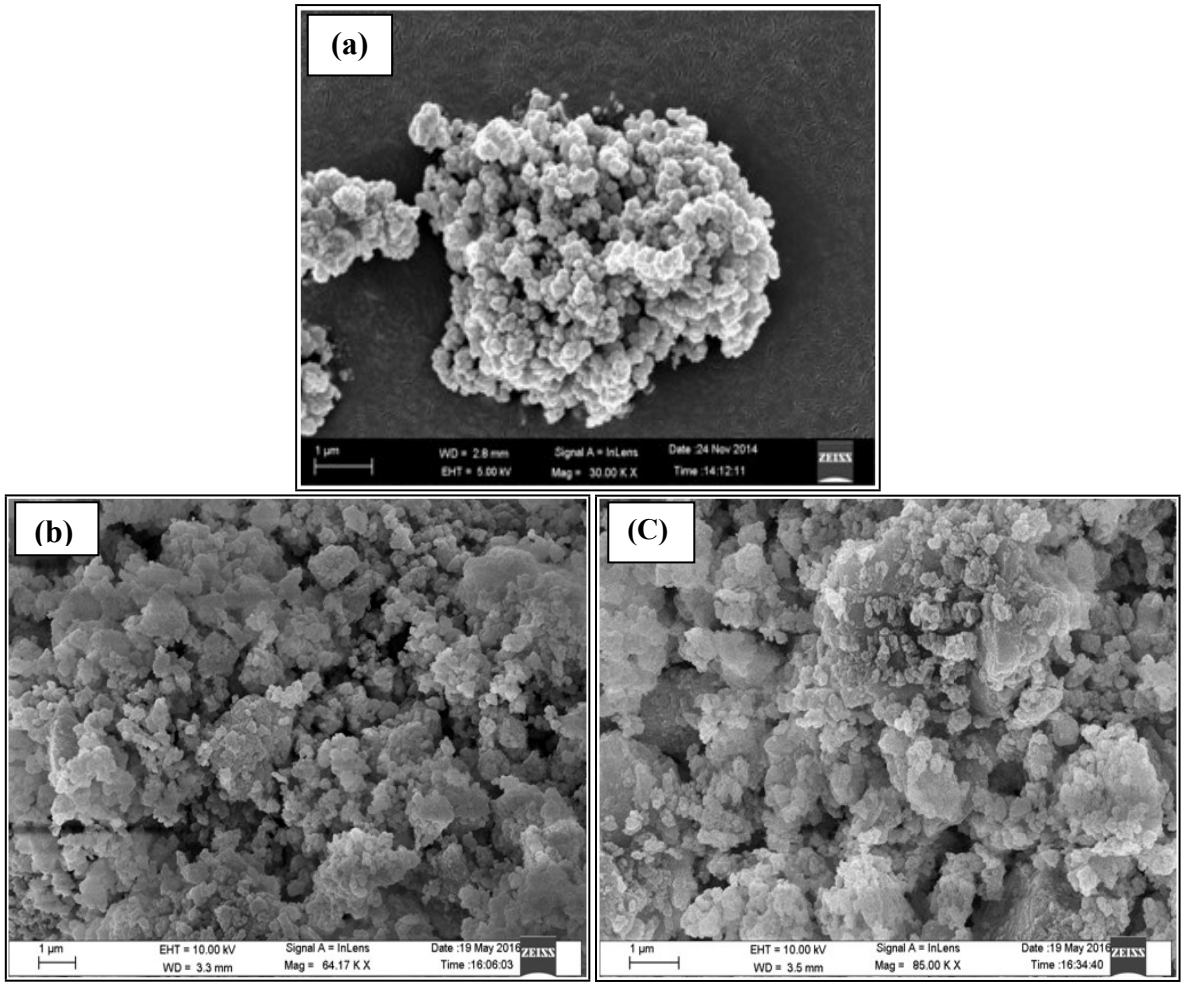

Fig S5 FE-SEM images of (a) NH_2-MIL-101 (Cr), (b) Fresh Au/NH_2-MIL-101(Cr) and (C) Recovered Au/NH_2-MIL-101(Cr)

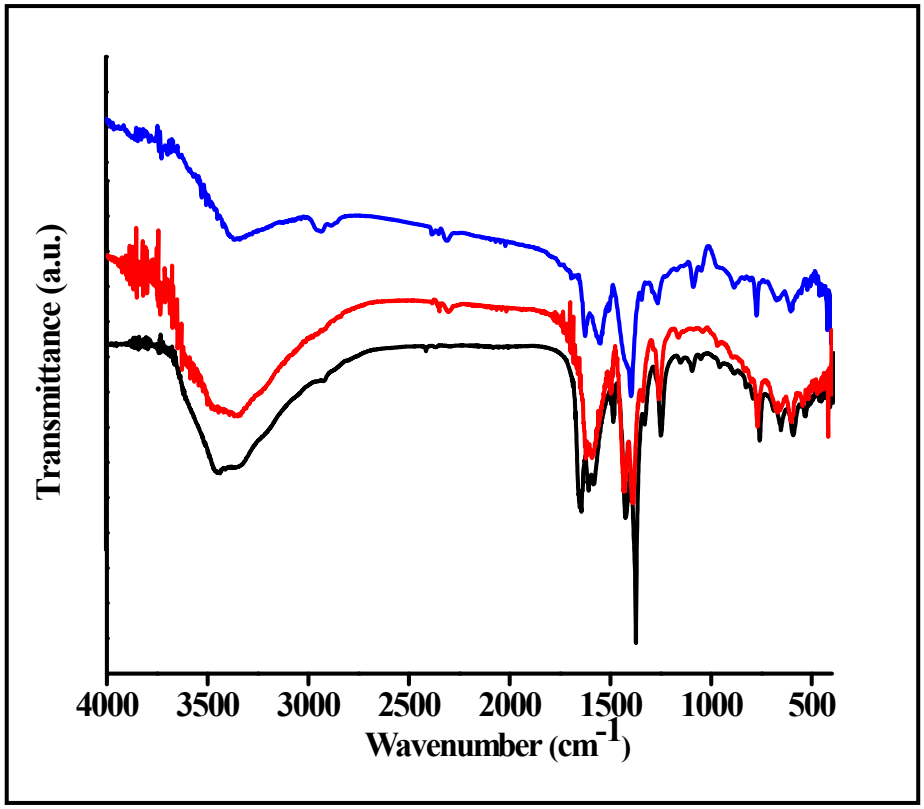

Fig S6 FT-IR Spectra of NH_2-MIL-101(Cr) (black), Fresh Au/NH_2-MIL-101(Cr) (red) and recovered Au/NH_2-MIL-101(Cr) (blue)

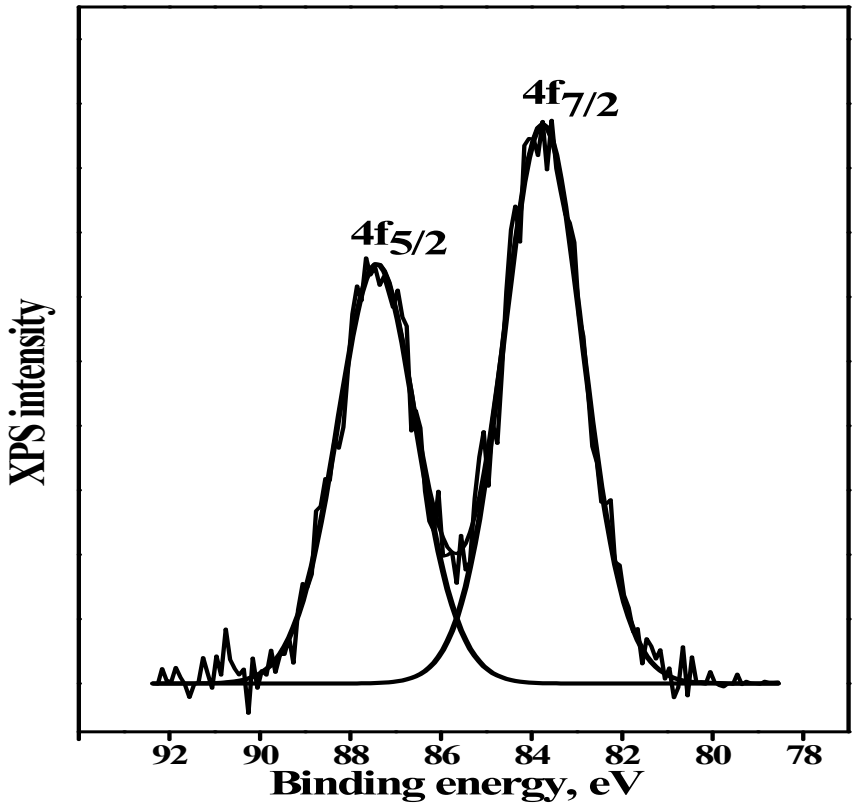

Fig S7 XPS spectrum of metallic gold nanoparticles supported on NH_2-MIL-101(Cr)

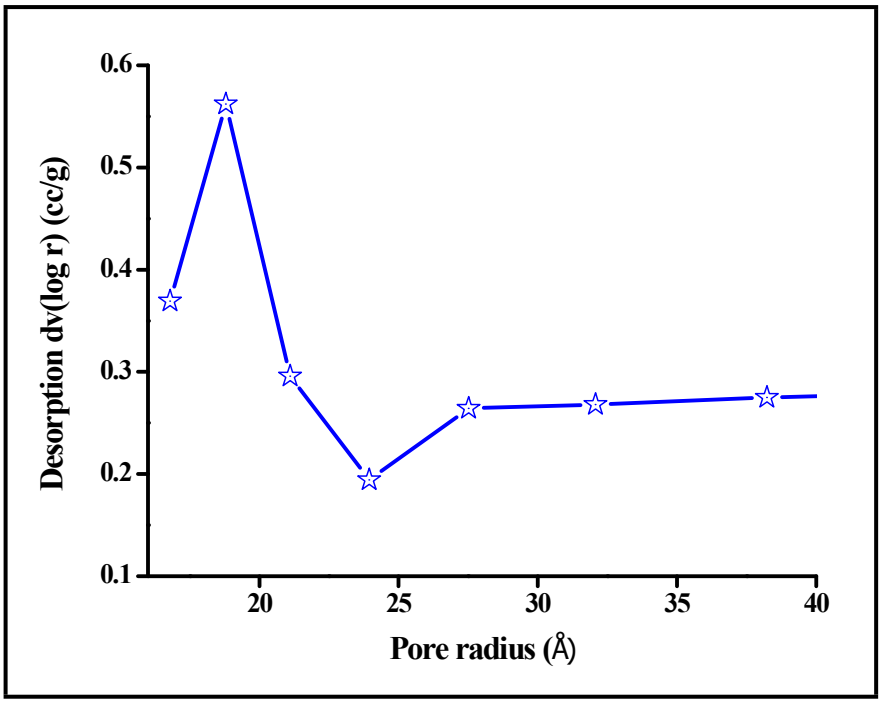

Fig S8 BJH plot of Au/NH_2-MIL-101(Cr)

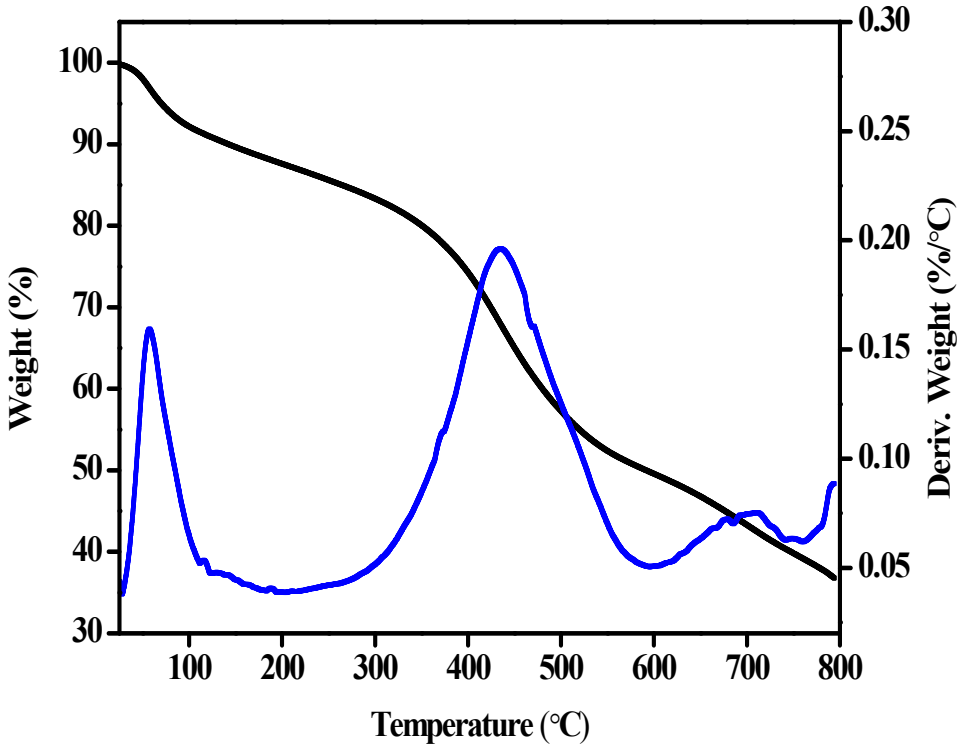

Fig S9 Thermogravimetric (black) and derivative curve (blue) of Au/NH_2-MIL-101(Cr)

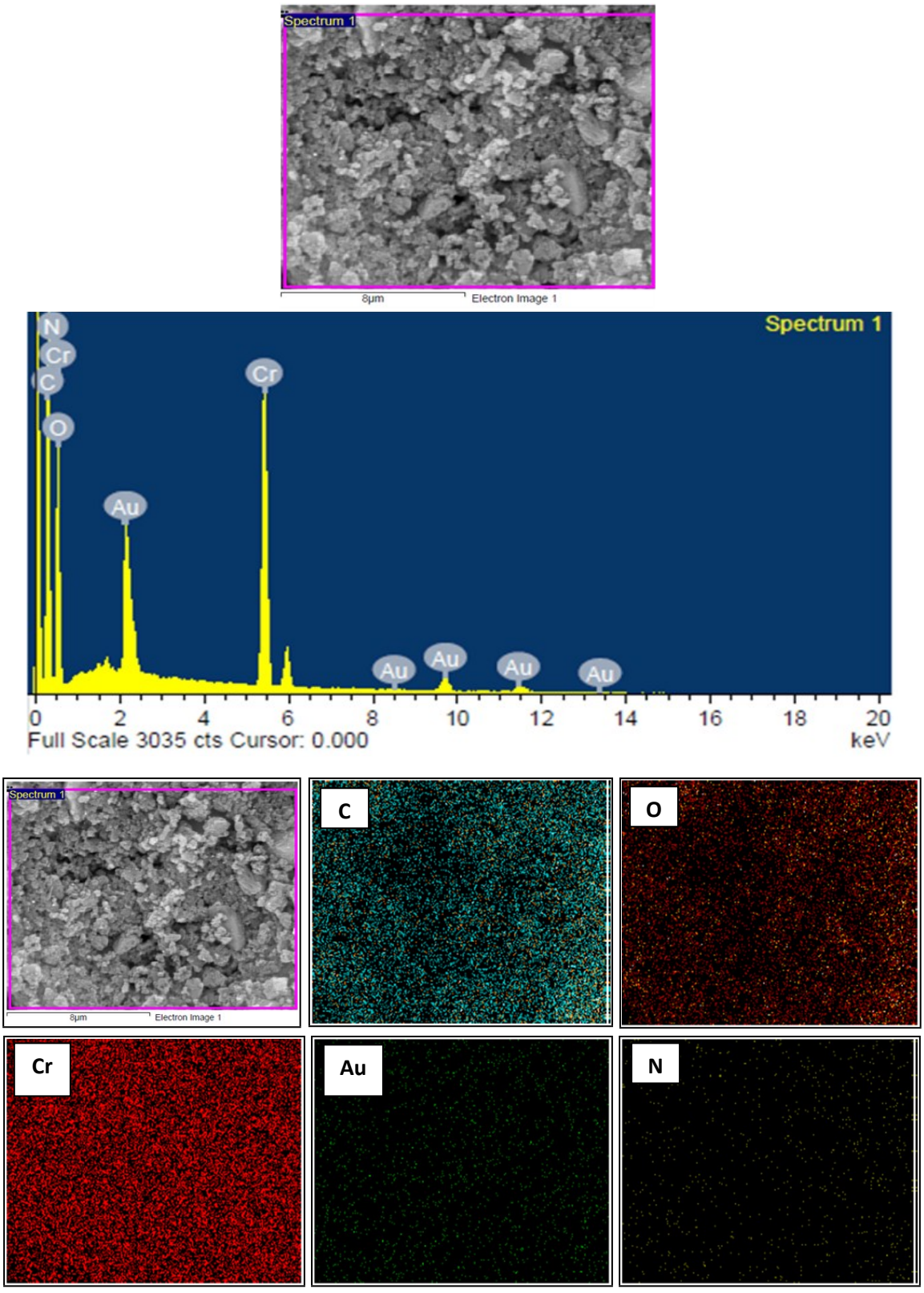

Fig S10 EDS and mapping analysis of the recovered Au/NH_2-MIL-101(Cr)

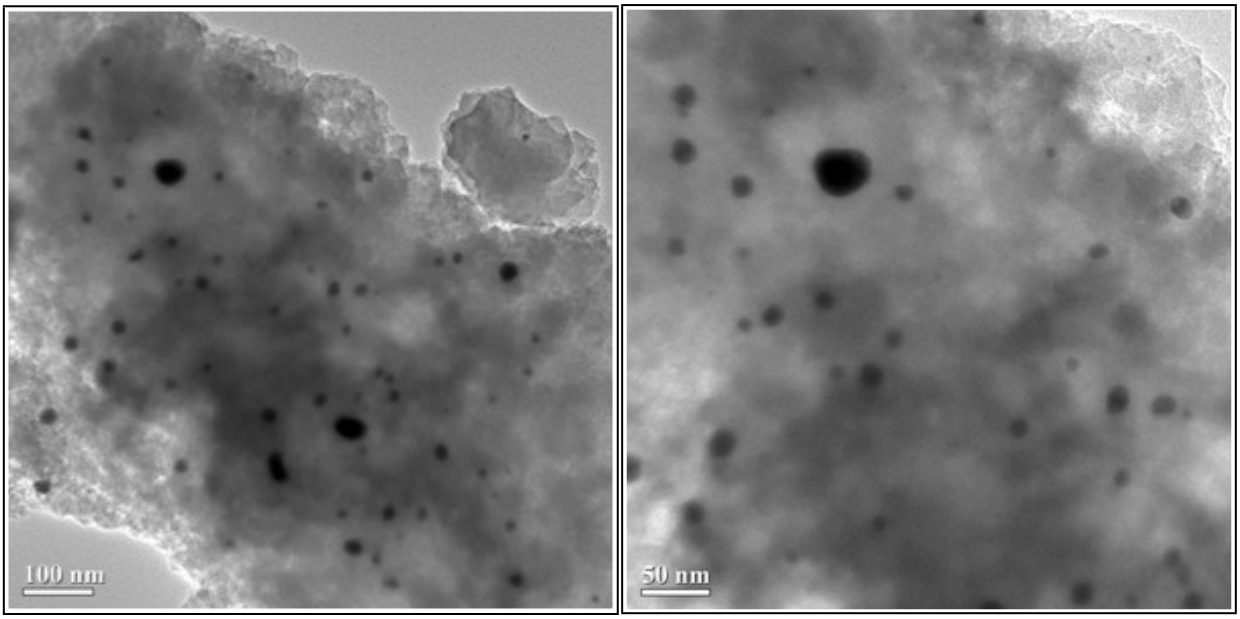

Fig S11 TEM images of the recovered Au/NH_2-MIL-101(Cr)

Table S1 Effect of reaction time[a]

Entry	Time (h)	Conversion (%)	Selectivity (%)			
			Styrene oxide	Benzaldehyde	Phenylacetaldehyde	Other products
1	4	55.9	84.4	0.0	0.0	15.5
2	8	88.2	74.7	0.0	0.35	24.9
3	12	97.02	19.9	48.3	13.8	17.8

[a]Reaction condition: Styrene (1 mmol), TBHP (1.5 mmol), toluene (5 mL), Temperature (110° C), Au/NH_2-MIL-101(Cr) (0.025 mol%), [b]GC conversion and selectivity

Table S2 Epoxidation of styrene by TBHP in presence of different gold- based catalyst

Entry	Catalysts	Conversion (%)	Selectivity[a] (%)	TOF (mol $g^{-1}h^{-1}$)[c]	Ref.
1	Au/CaO(HDP)[b]	53.6	60.2	0.23	10
2	Au/BaO (HDP)	55.9	53.5	0.19	10
3	Au/SrO (HDP)	53.0	44.8	0.15	10
4	Au/MgO	62.6	54.3	0.28	25
5	Au-*meso*-Al_2O_3	84.3	69.0	0.35	25
6	Au-PMO-SBA-15	94.8	75.0	0.40	25
7	Au/SiO_2	80.6	38.1	0.28	A
8	GNP/PEG6000-VIC	20.4	62.0	1.32	B
9	Au/Yb_2O_3(HDP)	63.5	54.8	0.17	C
10	Au/NH_2-MIL-101(Cr)	88.2	74.7	1.69	Present Work

[a] Selectivity w.r.t styrene oxide

[b] HDP= homogeneous deposition–precipitation

[c]Turnover frequency (TOF) is calculated by the expression [product]/[Au]×time (h^{-1})

References

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