Supporting information

Shape and size controlled synthesis of Cu nanoparticles-wrapped on RGO nanosheet catalyst and their outstanding stability and catalytic performance in the hydrogenation reaction of dimethyl oxalate

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Synthesis of GO NSs using modified Hummer method

Modified Hummers method was utilized to synthesize graphene oxide from the oxidation of high purity graphite powder. 96.0 ml Conc H_2SO_4 was added gradually to a mixture of 2 gm purified graphite flakes and 1 gm of sodium nitrate with keeping in ice bath. After around 30 min of vigorous magnetic stirring, 6 gm of $KMnO_4$ was added gradually and very carefully and stirred for 2 h under 20 °C as maintained by using ice bath. The mixture was placed in an oil bath whose temperature was maintained around 35 °C by a hot plate and magnetically stirred for 20 h after which the mixture turned into heavy brownish pasty color. Then, 150 ml di- water was added gradually within vigorous stirring. When the temperature increased with huge toxic gas bubbling, the more di-water was added until the solution diluted with 240 ml. When the diluted suspension color changed into brilliant yellow, 5 ml of H_2O_2 as strong oxidizing agent was added to it. After 2 h of continuous stirring, the mixture was filtered and washed by rinsing and centrifugation with mixture of 10% HCl. Then ultra-pure ethanol and di-water was added for several times to increase the pH value towards neutral. The resulting filtered mixturewas dried in oven for 24 h approximately at temperature 70 °C, and finally, solid GO powder was obtained.

Table S1 Physico-chemical properties of the prepared catalysts

Type of Catalyst	**S_{BET} (m2/g)**	**Pore diameter (nm)**	**$Cu^{+}/(Cu^{+}+Cu^{0})$ %**	**TOF value (h^{-1})**
Cu/RGO (US)	43.8	8.1	27	4.8
Cu/RGO (NH_4OH)	21.9	7.3	28.3	15.3
Cu/RGO (US/NH_4OH)	37.4	18.4	34	17.1
Cu/RGO (10 wt%)	49.6	8.2	26.3	12.6
Cu/RGO (25 wt%)	37.4	18.4	34	17.1
Cu/RGO (45 wt%)	37	19.1	26	14

Table S2 Reaction condition for the catalysts used in the comparison of the catalytic activity (Related to Table. 1)

Ref	Reaction temperature (ºC)	H2/DMO Ratio mol mol^{-1}
1	200	80
4	210	300
12	80	17.5
13	220	110
32	220	80
38	180	150
39	210	200
This work	210	200

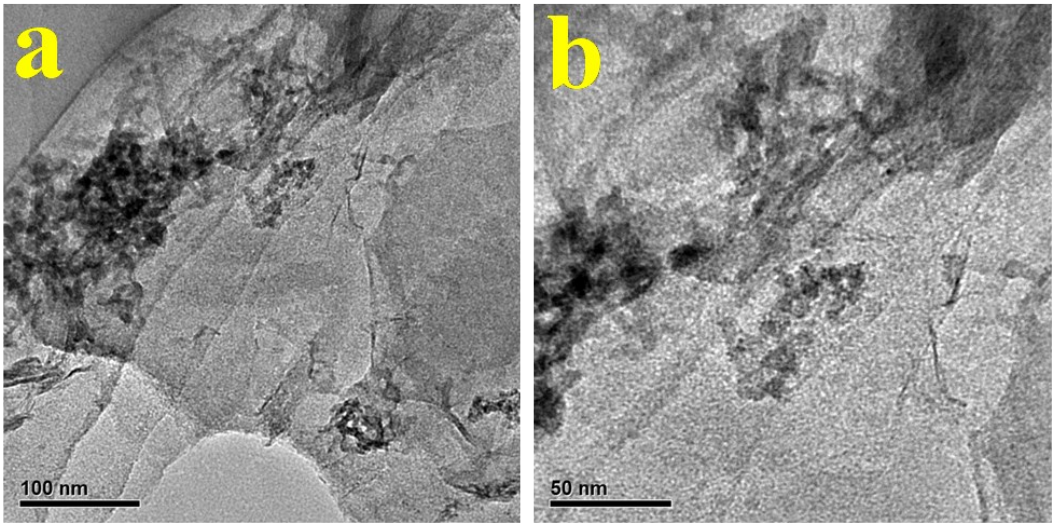

Fig. S1 TEM images for the Cu/RGO catalyst (US)

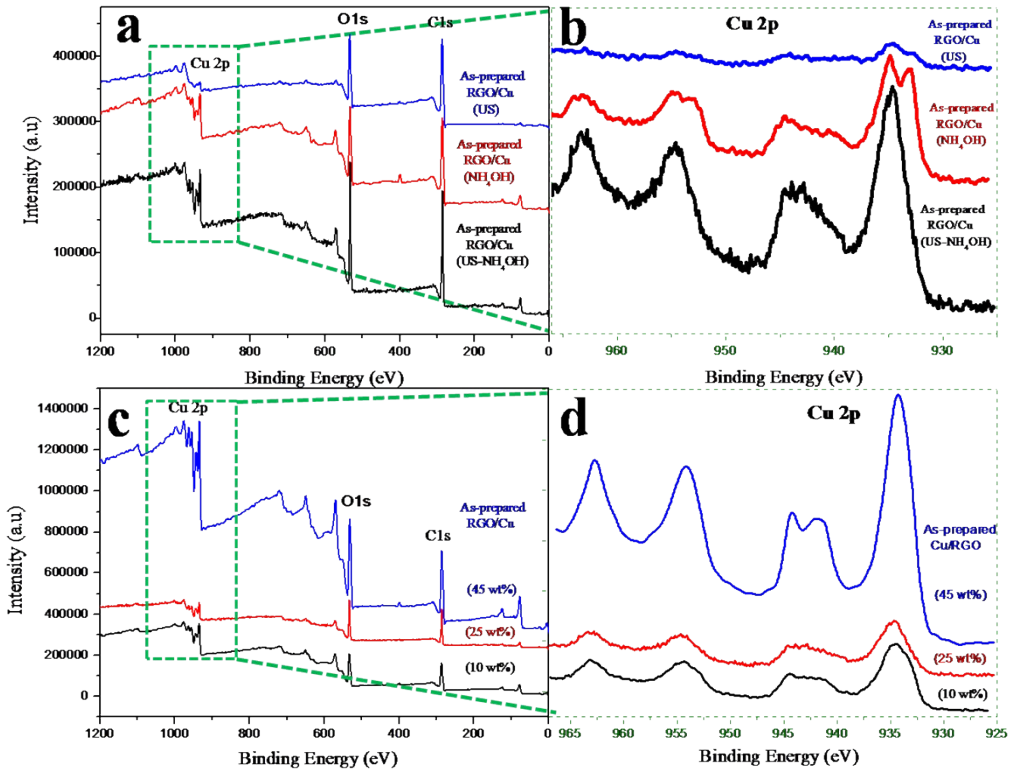

Fig. S2 XPS survey and analogues high resolution images of Cu 2p for Cu/RGO catalysts (a,b) synthesized in different reaction condition and (b) synthesized in presence of ultrasound and ammonia within different Cu wt% loading.

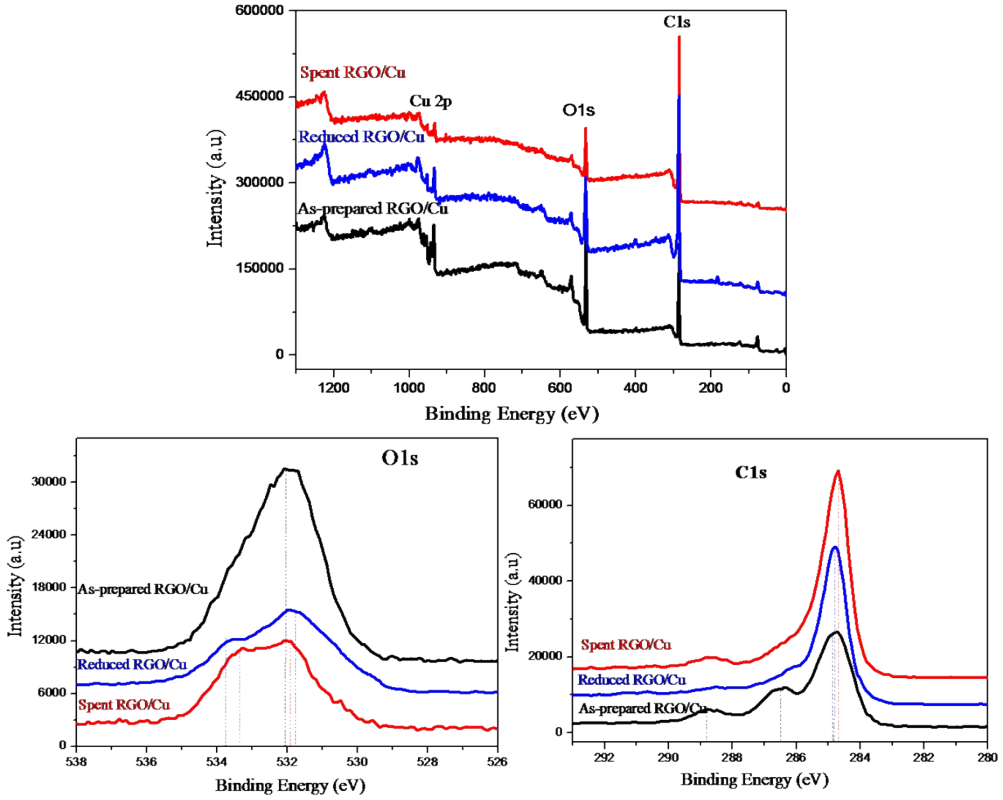

Fig. S3 XPS and HR-XPS to as-prepared, reduced and spent Cu/RGO catalyst to show the shift in the bending Energy values after reducing and used catalyst.

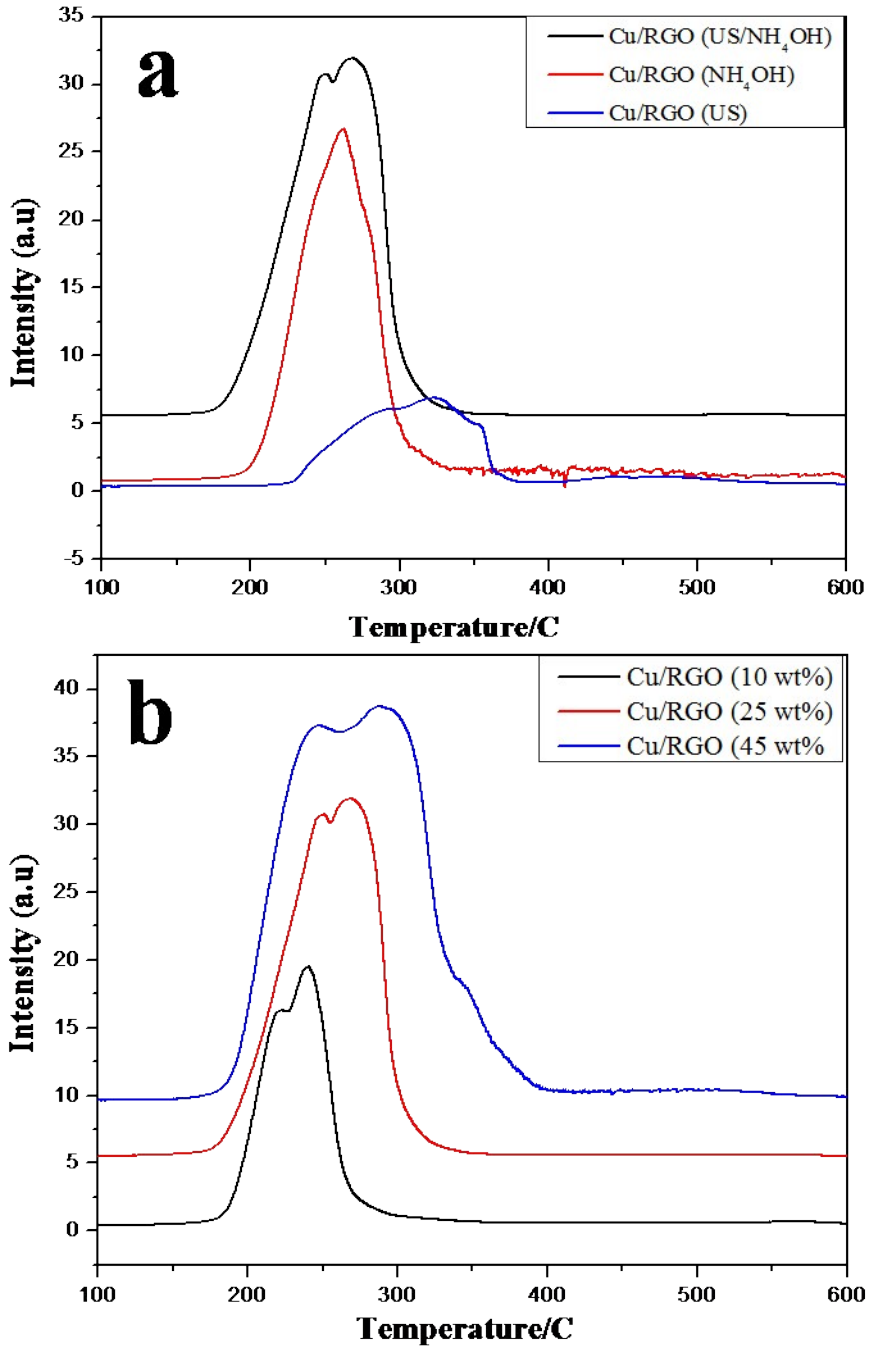

Fig. S4 H2-TPR for Cu/RGO catalysts synthesized (a) in different reaction condition and (b) synthesized in presence of ultrasound and ammonia within different Cu wt% loading.

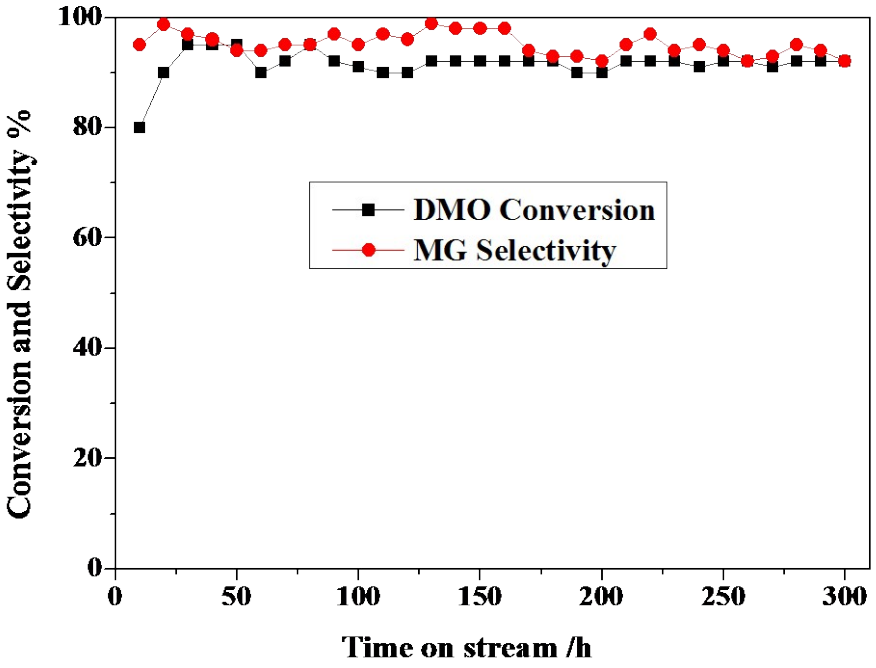

Fig. S5 MG and DMO conversion ratio for the spent Cu/RGO catalyst after 300 h of reaction time.

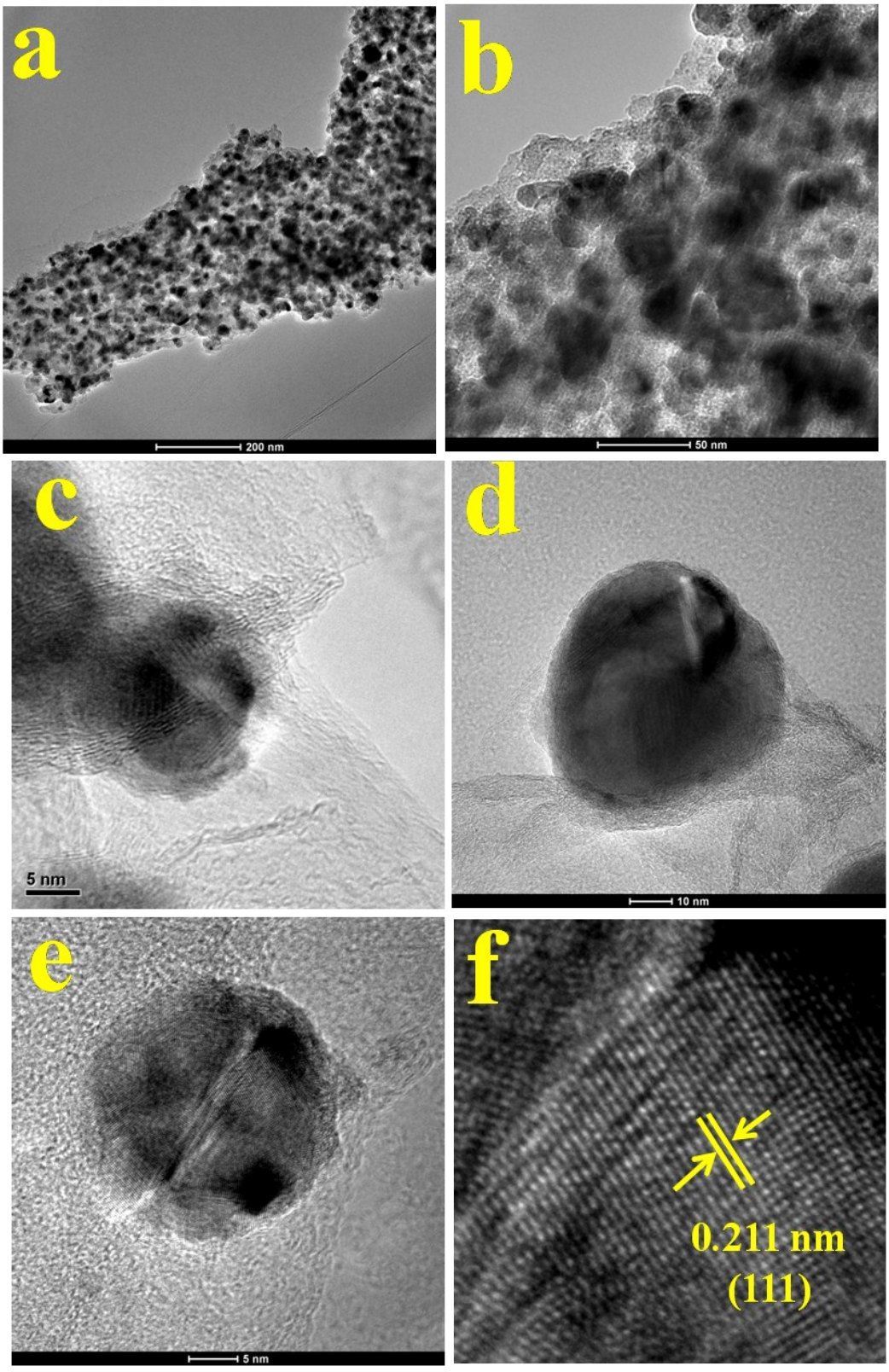

Fig. S6 TEM and HRTEM image for the spent Cu/RGO catalyst