Synthesis of glycerol carbonate from glycerol and urea with gold-based catalysts

Supplementary Material

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Table S1 Reusability data with 2.5 wt% Au/MgO synthesized via an impregnation method[a]

Entry	Catalyst	Conv. (%)	Selectivity (%)				Glycerol Carbonate Yield (%)
			Glycerol carbonate	5	7	9	
1	Blank	59	36	44	7	13	21
2	MgO	67	37	37	10	16	27
	2.5wt%Au/MgO	81	68	16	4	12	56
3	Fresh						
4	2.5wt%Au/MgO	79	71	16	3	10	56
	After 1st used						
5	2.5wt%Au/MgO	78	65	19	5	11	51
	After 2nd used						
6	2.5wt%Au/MgO	80	63	20	5	11	51
	After 4th used						
7	2.5wt%Au/MgO	90	63	12	6	19	57
	After 6th used						
8	2.5wt%Au/MgO	87	81	8	2	9	70
	After 8th used						
9	2.5wt%Au/MgO	80	69	17	4	10	55
	After 10th used						

[a]Reaction conditions: Glycerol to Urea molar ratio: (1:1.5), Temperature: 150 ^{o}C, Catalyst: 0.25 g, Reaction time: 4 hrs, N_2 flow. Product (**5**): 2,3-dixydroxylpropyl carbamate, Product (**7**): 4-(hydroxymethyl) oxazolidin-2-one, Product (**9**):(2-oxo-1,3-dioxolan-4-yl) methyl carbamate.

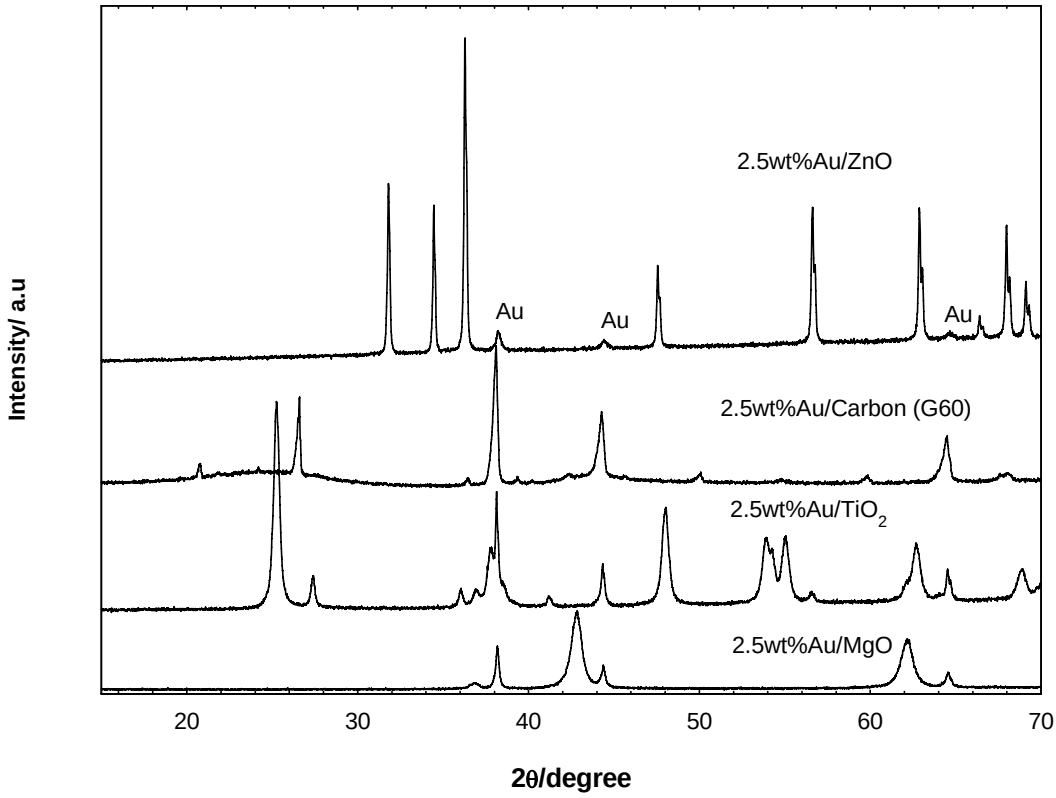

Fig. S1 XRD diffractogram of 2.5 wt% Au support**ed** on MgO. TiO_2**,** carbon and ZnO.

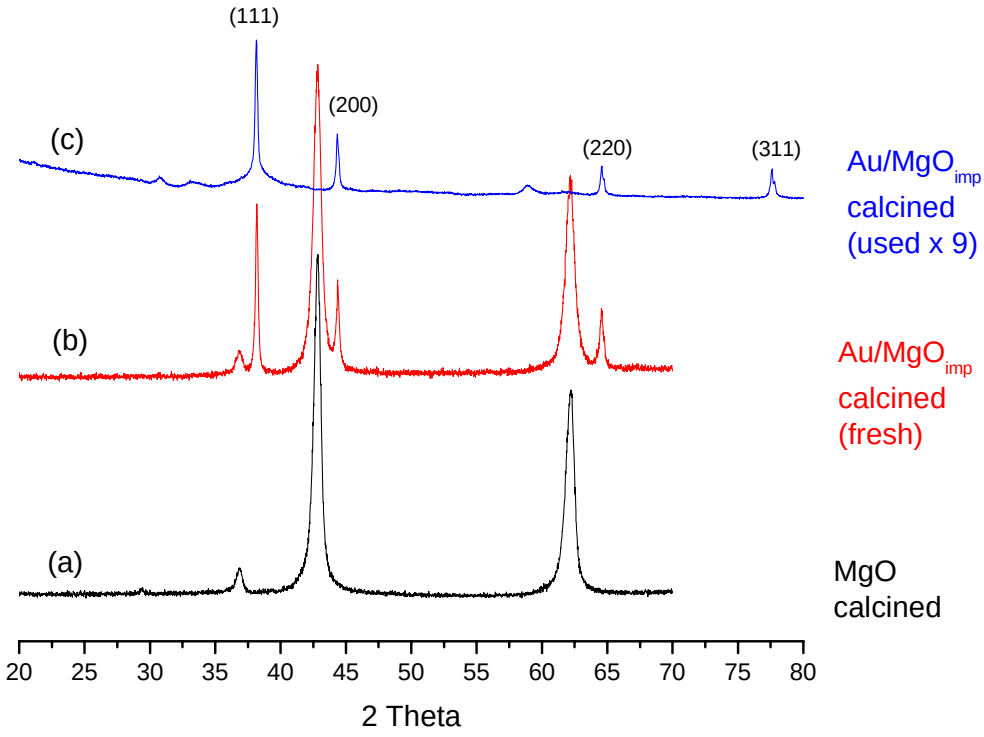

Fig. S2 X-ray diffraction patterns for (a) MgO, calcined at 400 ^{o}C for 3 h in static air; (b) 2.5 wt. % Au/MgO prepared by impregnation and calcined at 400 ^{o}C for 3 h in static air and (c) 2.5 wt. % Au/MgO prepared by impregnation and calcined at 400 ^{o}C for 3 h in static air after 9 catalytic cycles.

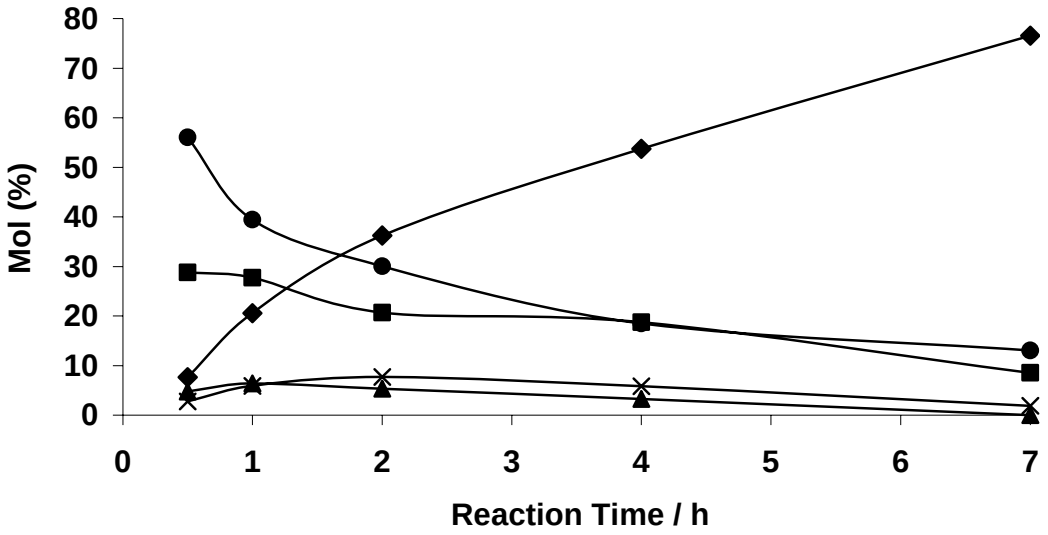

Fig. S3 TOL data in molar composition obtained with 2.5 wt% Au/MgO (Mol vs Time). Key: ◆ 4-(hydroymethyl)-1,3-dioxolan-2-one, ■ 2,3-dihydroxyproyl carbamate, ▲ 4-(hydroxymethyl) oxazolidin-2-one, × (2-oxo-1,3-dioxolan-4-yl) methyl carbamate, ● glycerol.

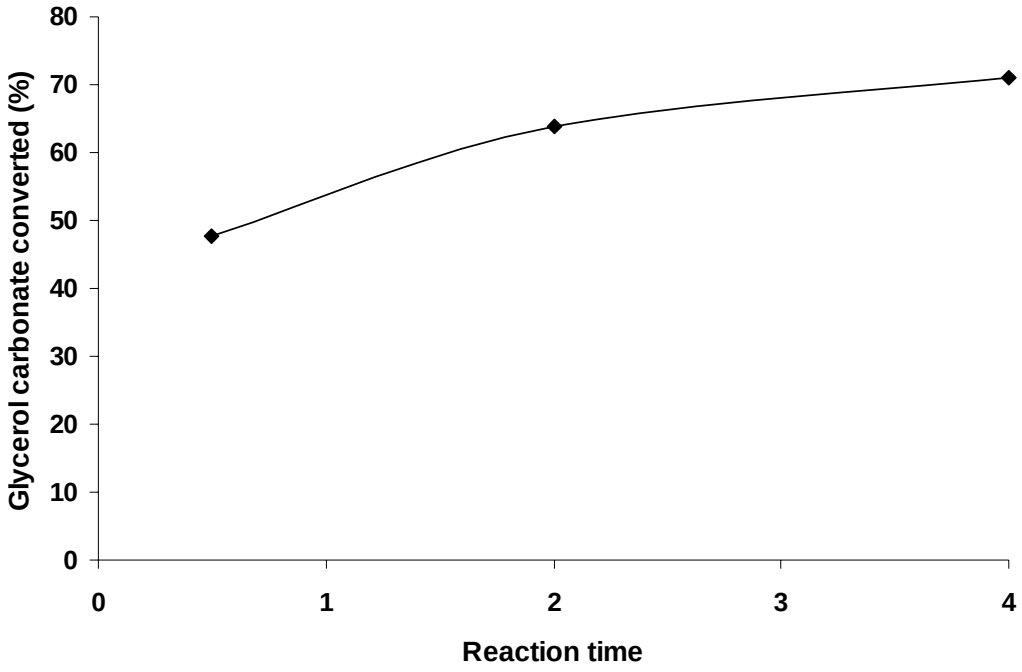

Fig. S4 Plot of glycerol carbonate converted from reaction of glycerol carbonate with urea at 150^{o}C under flow of nitrogen.

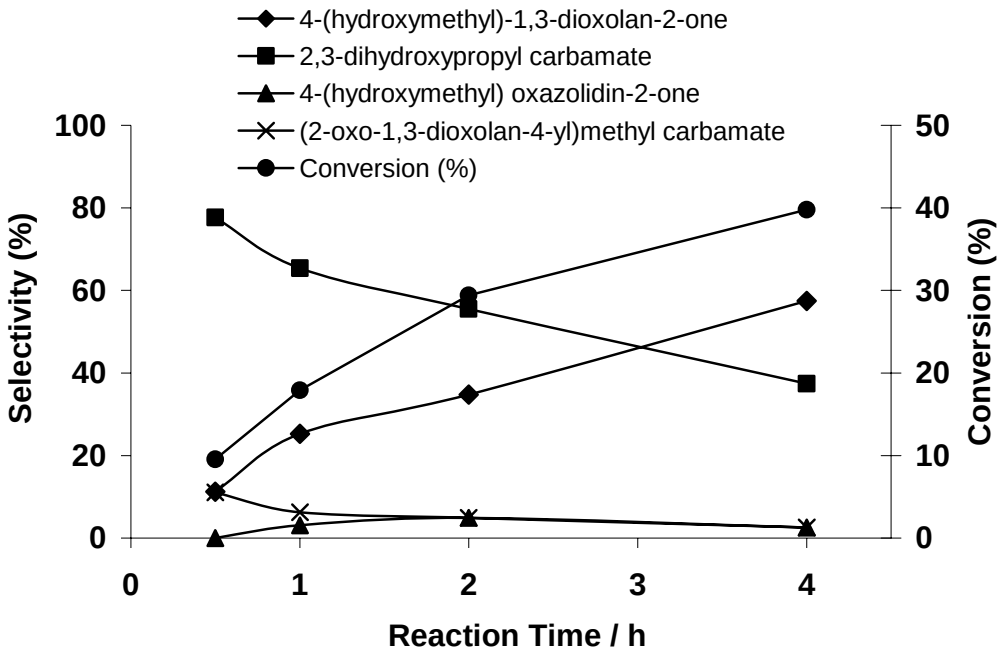

Fig. S5 TOL blank glycerol carbonate synthesis reaction performed with a 2:1 glycerol: urea. Key: ◆ selectivity to 4-(hydroymethyl)-1,3-dioxolan-2-one, ■ selectivity to 2,3-dihydroxyproyl carbamate, ▲ selectivity to 4-(hydroxymethyl) oxazolidin-2-one, × selectivity to (2-oxo-1,3-dioxolan-4-yl) methyl carbamate and, ● glycerol conversion.

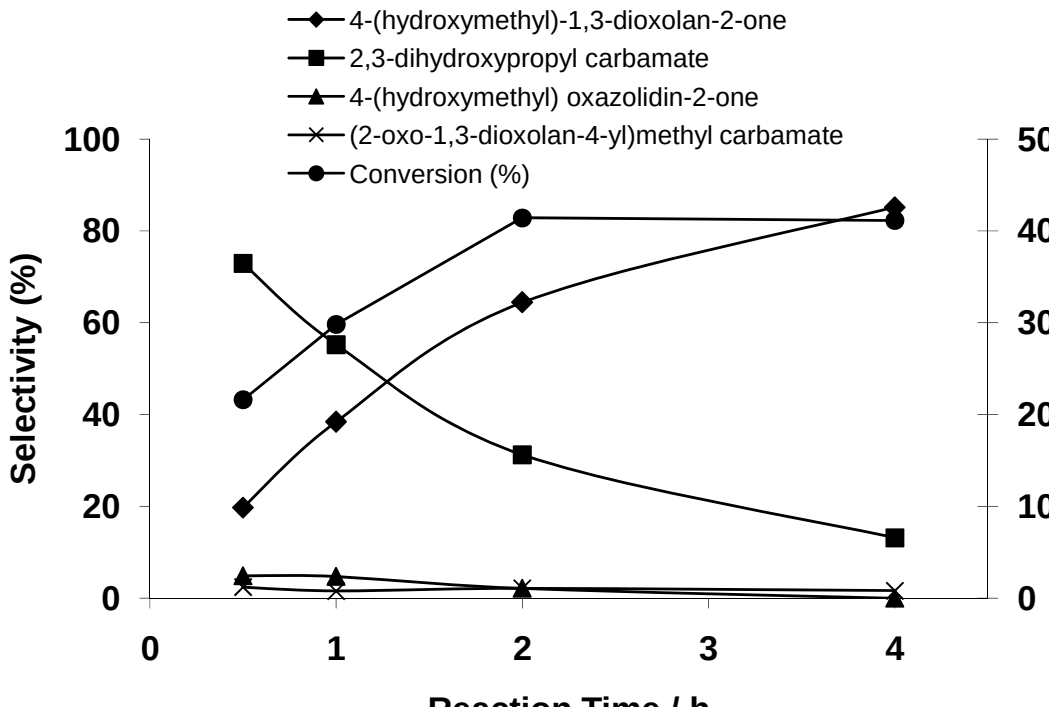

Fig. S6 TOL of 2:1 glycerol to urea ratio with presence of 2.5 wt% Au/MgO impregnation catalyst. Key: ◆ selectivity to 4-(hydroymethyl)-1,3-dioxolan-2-one, ■ selectivity to 2,3-dihydroxyproyl carbamate, ▲ selectivity to 4-(hydroxymethyl) oxazolidin-2-one, × selectivity to (2-oxo-1,3-dioxolan-4-yl) methyl carbamate and, ● glycerol conversion.