Supporting Information

Glycerol selective oxidation to lactic acid over platinum-vanadium bimetallic catalysts supported on activated carbon

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Table S1: Literature reports on glycerol oxidation to lactic acid process.

Catalysts	T (°C)	P (bar)	Gas Medium	time (hr)	base	base/gly (mol/mol)	gly/ metal (mol/mol)	conversion (%)	L.A. selectivity (%)	Ref
1.9Pt-4.7Ru/C	200	40	H_2	5	NaOH	0.8	700	100	37	1
1Au-1Pd/TiO_2	160	10	O_2	2	BF	-	2500	29.7	58.5	2
1.5Pt/Sn-MFI	100	6.2	O_2	24	BF	-	350	89.8	80.5	3
1Au-1Pt/TiO_2	90	1	O_2	1	NaOH	4	8000	30	86	4
0.4Au-0.3Pt/CeO_2	100	5	O_2	0.5	NaOH	4	680	99	80	5
1Pt-1Co/CeO_2	200	10	N_2	4	NaOH	1	720	85	87.7	6
0.5Au-0.5Pt/Al_2O_3	85	6 (mlpm)	O_2	-	NaOH	4	-	>90	40	7
0.5%Cu-1.0%Pt/AC	90	100 (mlpm)	O_2	4	LiOH	1.5	-	80	69.3	8
10%Ni-1Co/CeO_2	160	20	N_2	6.5	NaOH	1.5	58.82	97	95.88	9
1.39Pt-0.5Co/CeO_2	200	10	N_2	4	NaOH	1	-	98	54	10
1Au-0.5Ru/CZ	50	3	O_2	0.25	NaOH	1	1000	28	22	11

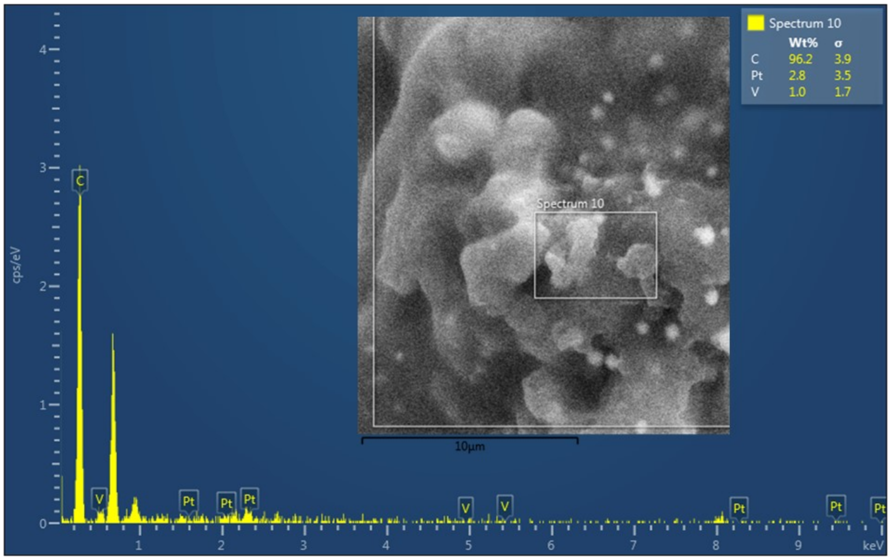

Figure S1: EDX spectrum of the 1Pt-1V/AC bimetallic catalyst**.**

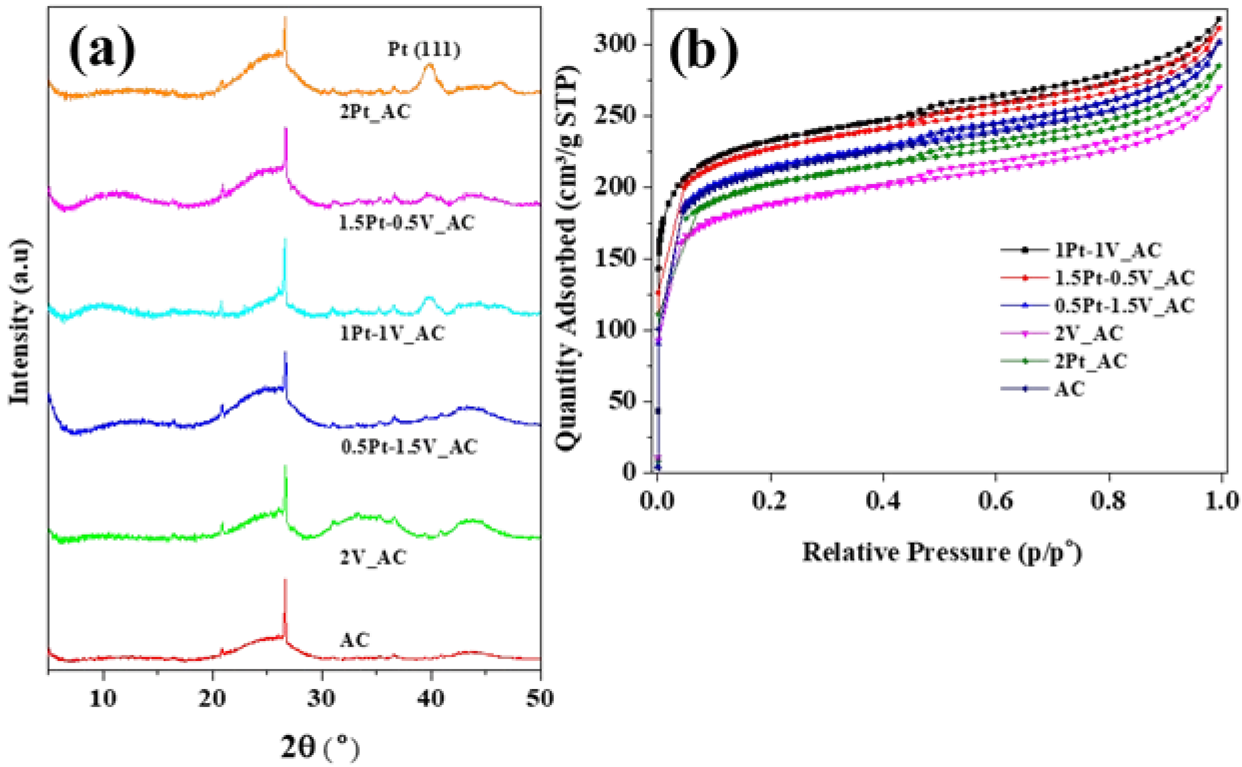

Figure S2: (a) XRD patterns (b) N_2 sorption isotherms of various activated carbon supported Pt-V bimetallic catalysts, synthesized in this study. The data for bare activated carbon support also included for the comparison.

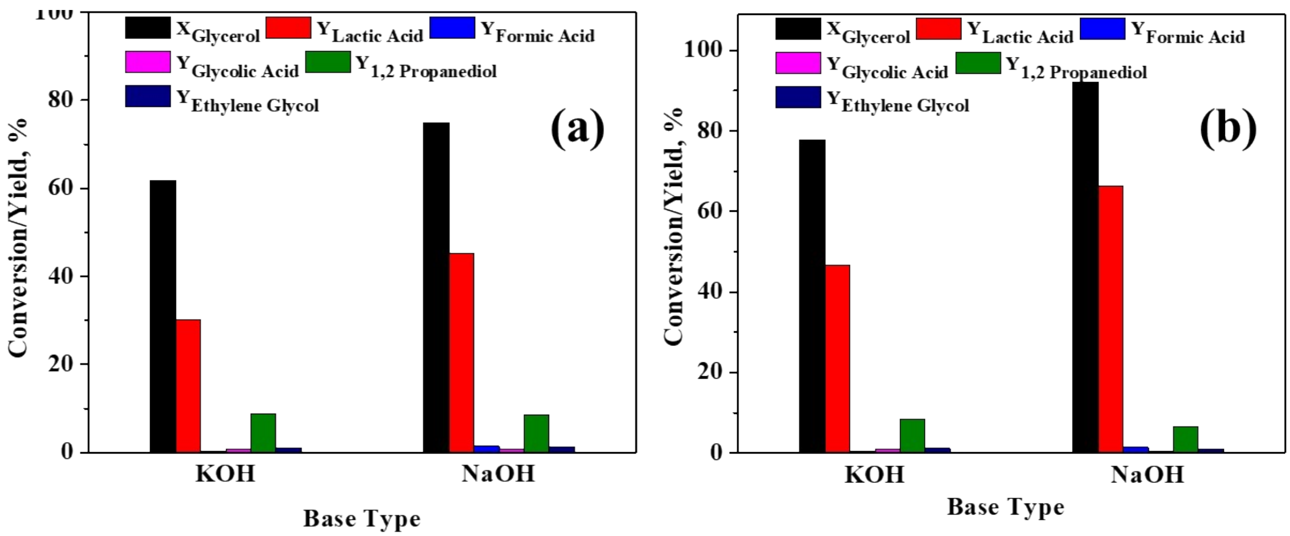

Figure S3: Effect of base type on glycerol to lactic acid conversion over 1Pt-1V/AC bimetallic catalyst: (a) 3 h and (b) 12 h . The other reaction conditions: 200 °C temperature, 5 bar air pressure, 1:1 base (KOH or NaOH) to glycerol molar ratio, and 0.05 g catalyst (8800 glycerol to metal molar ratio).

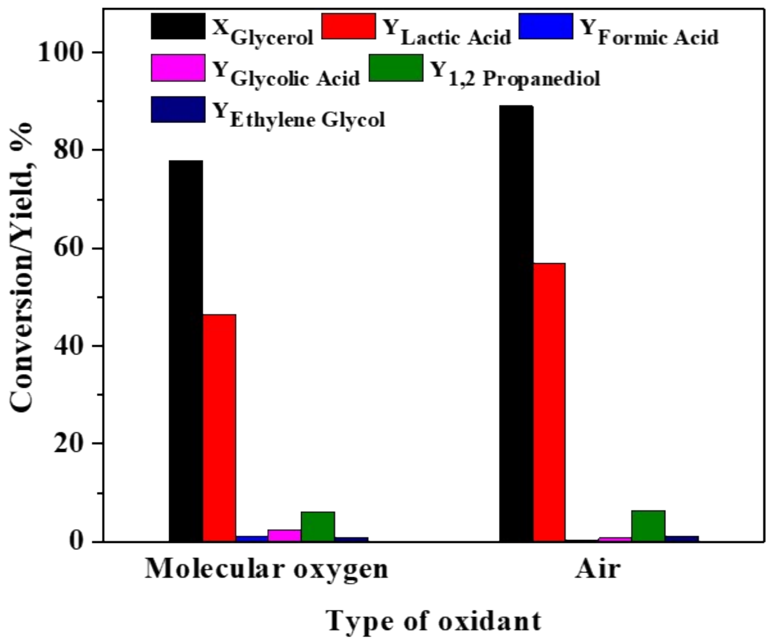

Figure S4: Effect of oxidant type on glycerol to lactic acid conversion over 1Pt-11V/AC bimetallic catalyst. (Reaction conditions: 200°C temperature, 5 bar air pressure, 12 h reaction time, 1:1 base (KOH) to glycerol molar ratio, and 0.1 g catalyst.)

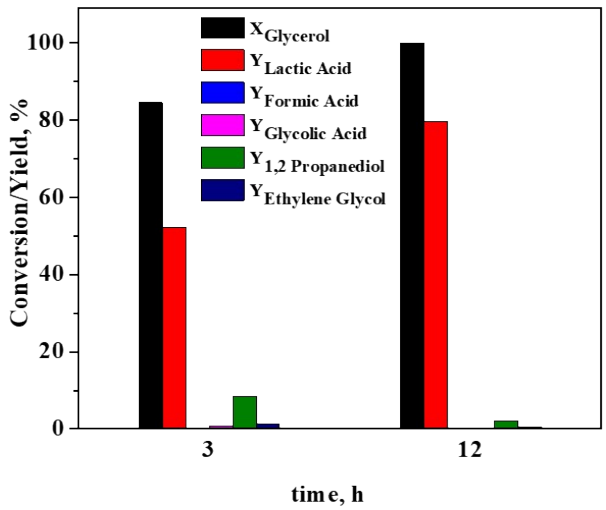

Figure S5: Glycerol to lactic acid conversion over 1Pt-1V/AC bimetallic catalyst: Effect of (a) reaction time (with NaOH as a base). The other reaction conditions: 200°C temperature, 5 bar air pressure, 1:1 base (NaOH) to glycerol molar ratio, and 0.1 g catalyst.

With the increase of catalyst loading from 0 to 0.05 (8800 mol/mol glycerol to metal molar ratio) and 0.1 g (4400 mol/mol), the GL conversion and the LA yield was significantly enhanced from 27 to 62.5 and 79.2% and from 5.5 to 31.0 and 41.0%, respectively (Figure. S6). Further, with an increase in the reaction time of 3 to 12 h, the GL conversion and LA yields were increased from 78.7 to 90.0% and 47.7 to 57.7%, respectively (Figure. S7). However, there is no formation of byproducts with a bare (0.0 g) catalyst, which means the process is a hydrothermal conversion. A considerable amount (8.23%) of 1,2-PDO was formed with an increasing catalyst amount to 0.05 and further increasing to 0.1 g; there is no change in 1,2-PDO yield. However, an increase in reaction time from 3 to 12 h showed a slight decrease in 1,2-PDO yield.

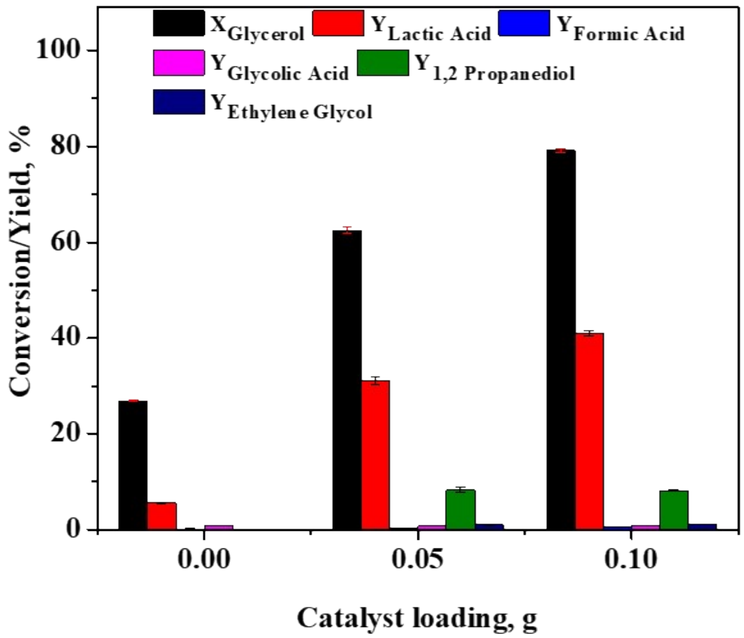

Figure S6: Effect of catalyst loading on glycerol to lactic acid conversion over 1Pt-1V/AC bimetallic catalyst (Reaction conditions: 200°C temperature, 5 bar air pressure, 3 h reaction time, and 1:1 base (KOH) to glycerol molar ratio).

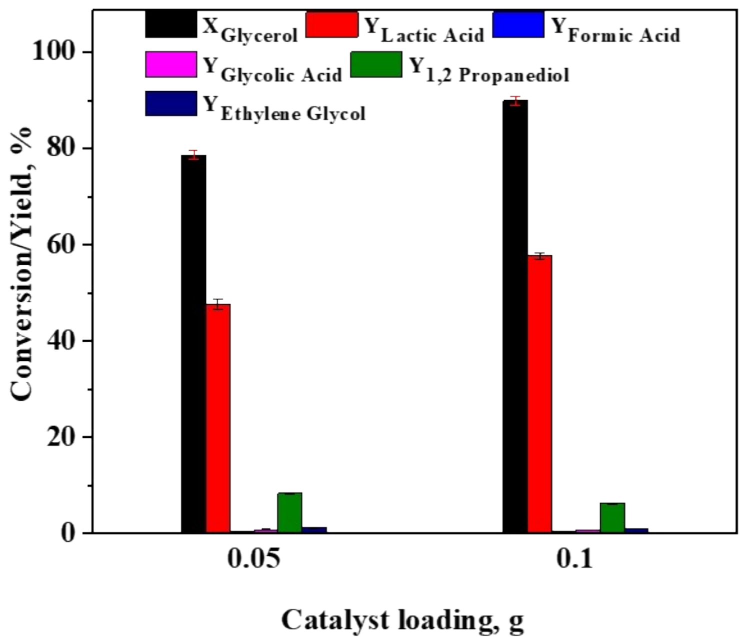

Figure S7: Effect of catalyst loading on glycerol to lactic acid conversion over 1Pt-1 V/AC bimetallic catalyst. (Reaction conditions: 200°C temperature, 5 bar air pressure, 12 h reaction time, and 1:1 base (KOH) to glycerol molar ratio.

Table S2: Carbon balance at various process conditions.

S. No	Process Conditions	CB (%)
1	160, 5 bar air, 12h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	77.36
2	180, 5 bbar air, 12h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	75.05
3	200, 5 bar air, 12h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	78.4
4	200, 5 bar air, 3h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	72.4
5	200, 10 bar air, 3h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	75.53
6	200, 15 bar air, 12h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	72.62
7	200, 5 bar air, 6h, KOH/Gly = 1 (mol/mol), Gly/Metal = 4400 (mol/mol)	72.82
8	200, 5 bar air, 12h, Base free, Gly/Metal = 4400 (mol/mol)	81.7
9	200, 5 bar air, 12h, KOH/Gly = 0.5 (mol/mol), Gly/Metal = 4400 (mol/mol)	71.13

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