Supporting information

Pt nanoparticles supported on porous sheath TiO_2 wrapped carbon nanotubes for selective glycerol electro-oxidation into tartronate

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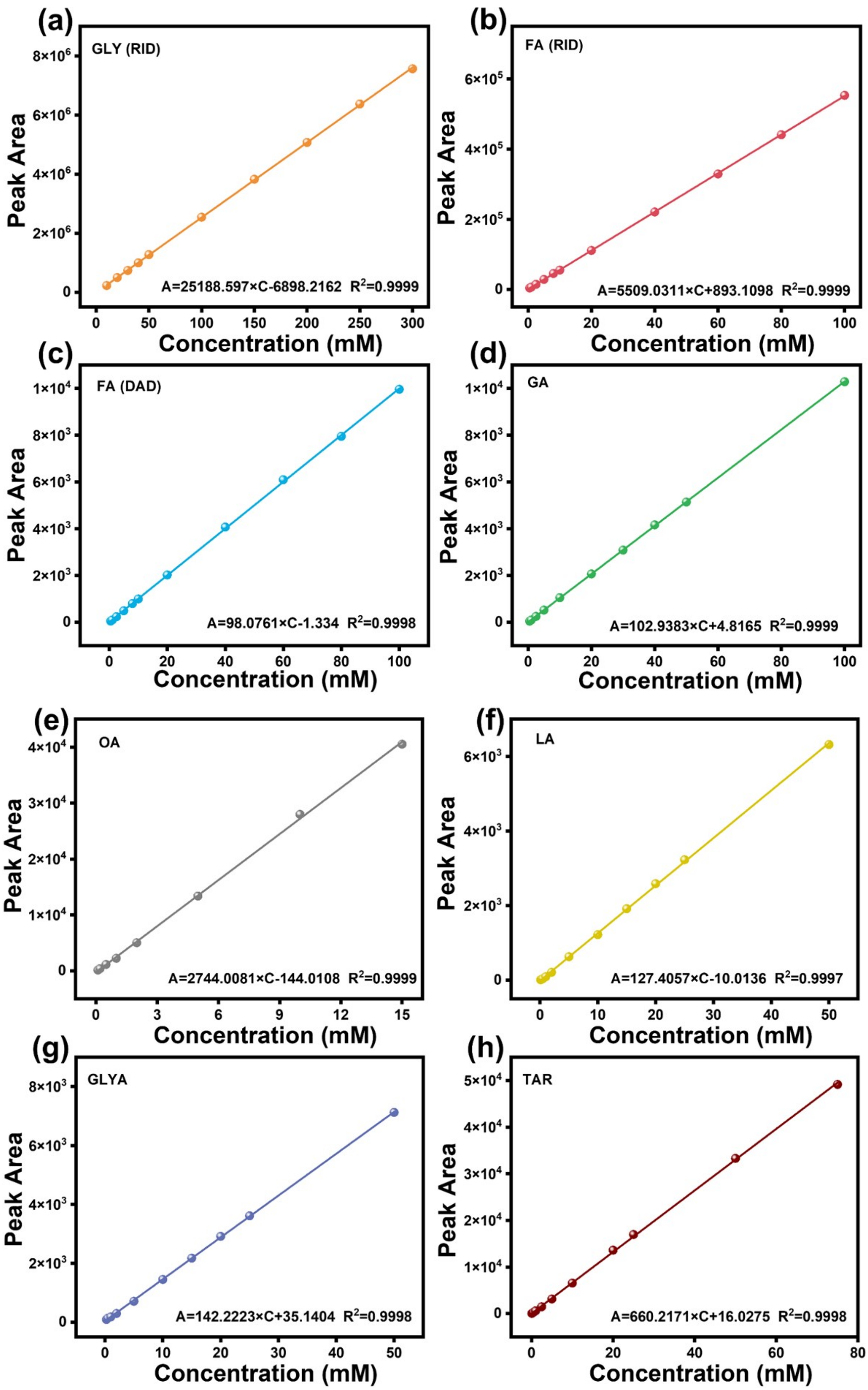

Fig. S1 The standard curves and corresponding linear fitting equations with correlation coefficients. **(a)** Glycerol and **(b)** FA with RID. **(c)** FA, **(d)** GA, **(e)** OA, **(f)** LA, **(g)** GLYA, and **(h)** TAR with DAD.

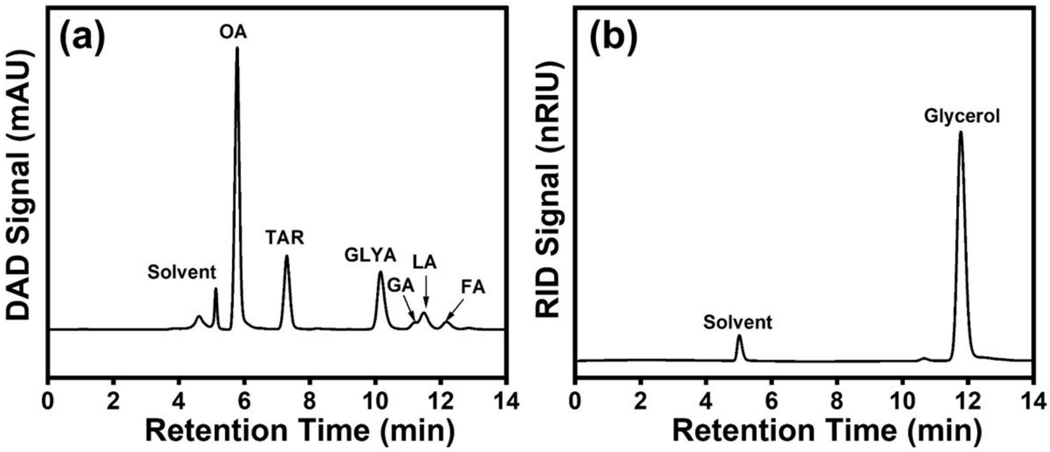

Fig. S2 HPLC chromatograms of **(a)** different products detected by DAD and **(b)** glycerol detected by RID.

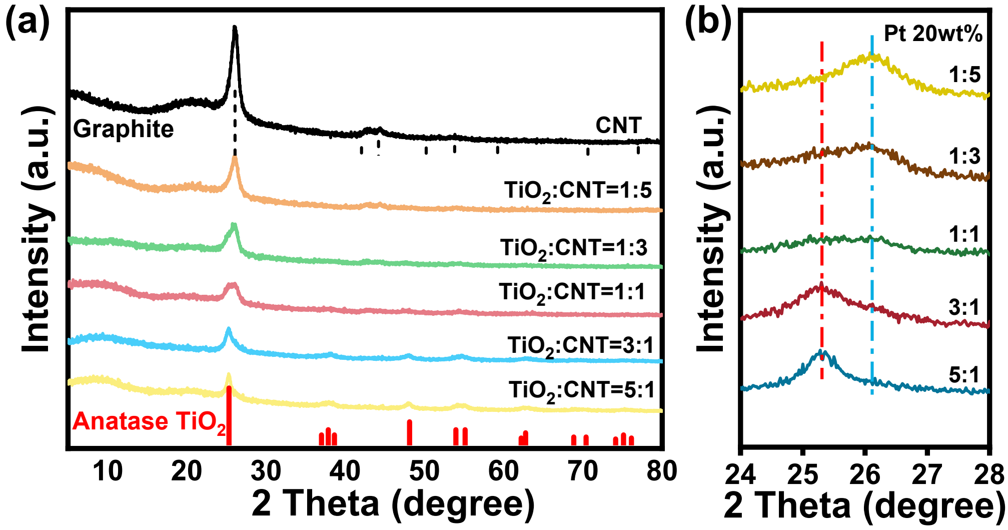

Fig. S3 XRD patterns of **(a)** different ratios TiO_2/CNT supports and **(b)** Partial enlarged XRD patterns of Pt-TiO_2/CNT catalysts with varying ratios of TiO_2/CNT.

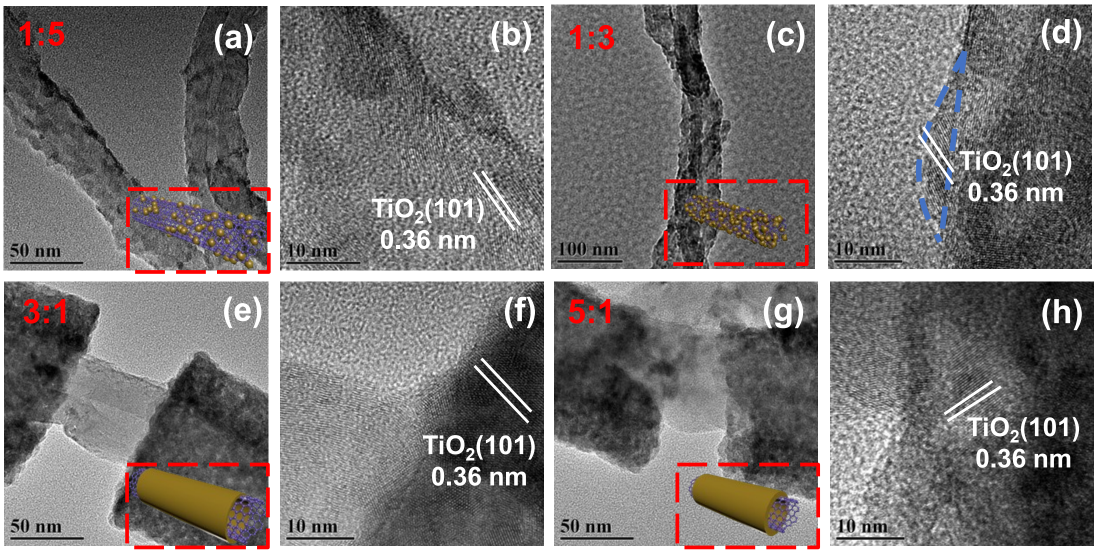

Fig. S4 TEM images of different ratios TiO_2/CNT supports with different magnification, **(a,b)** 1:5, **(c,d)** 1:3, **(e,f)** 3:1, **(g,h)** 5:1.

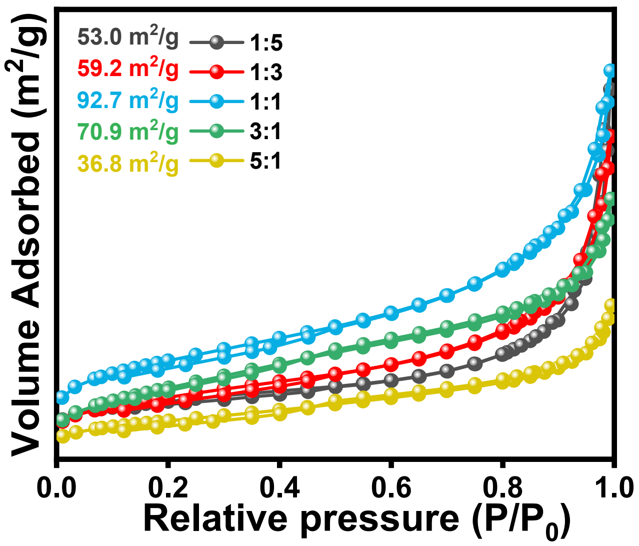

Fig. S5 N_2-adsorption-desorption isotherms of the supports with different ratios TiO_2/CNT.

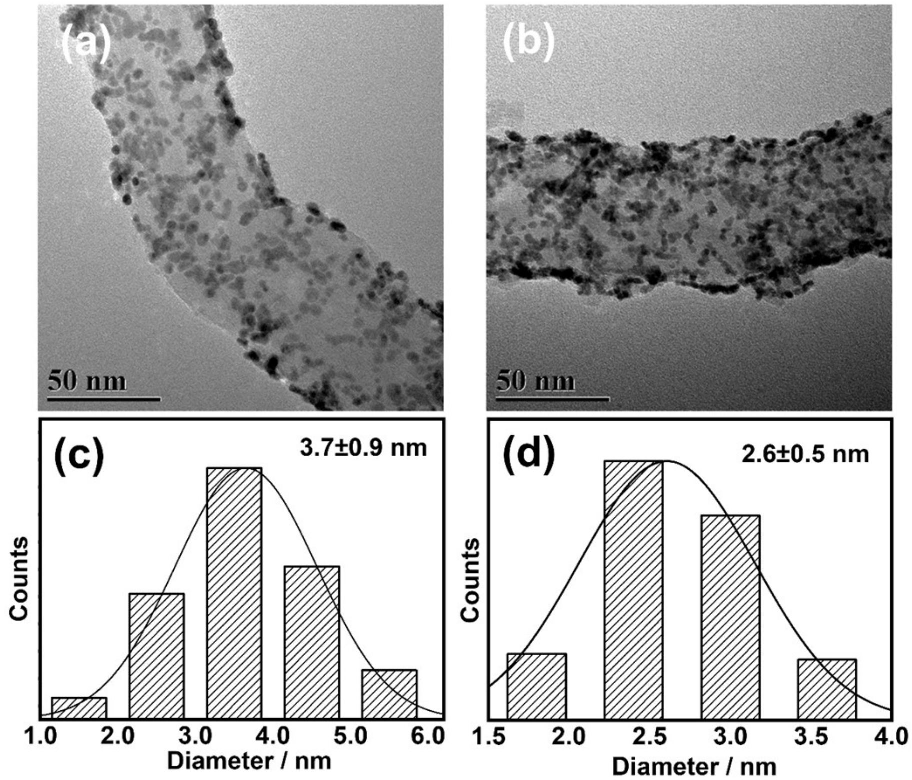

Fig. S6 The TEM images and corresponding size histograms of Pt nanoparticles of **(a,c)** Pt/CNT and **(b,d)** Pt-TiO_2/CNT.

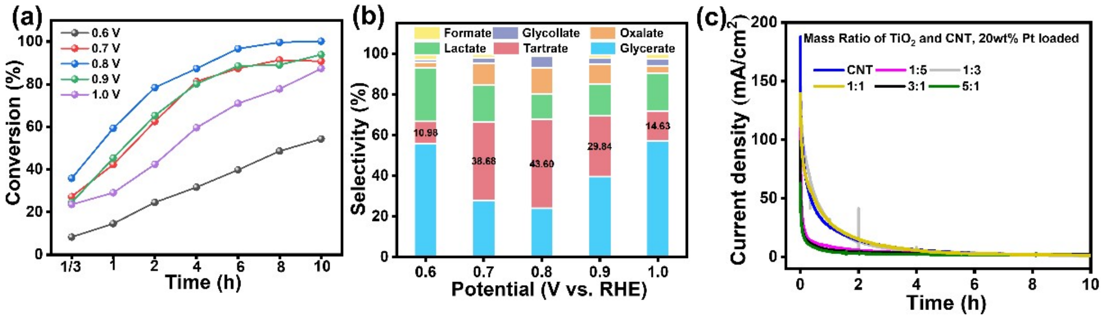

Fig. S7 (a) The glycerol conversion and **(b)** Selectivity of TAR after 10 h over Pt-TiO_2/CNT with different potential. **(c)** Amperometric i-t curve of Pt particles supported on TiO_2/CNT with different TiO_2:CNT ratios. **Condition:** 0.1 M glycerol with 1.0 M KOH at 60 ℃ and 0.8 V vs. RHE.

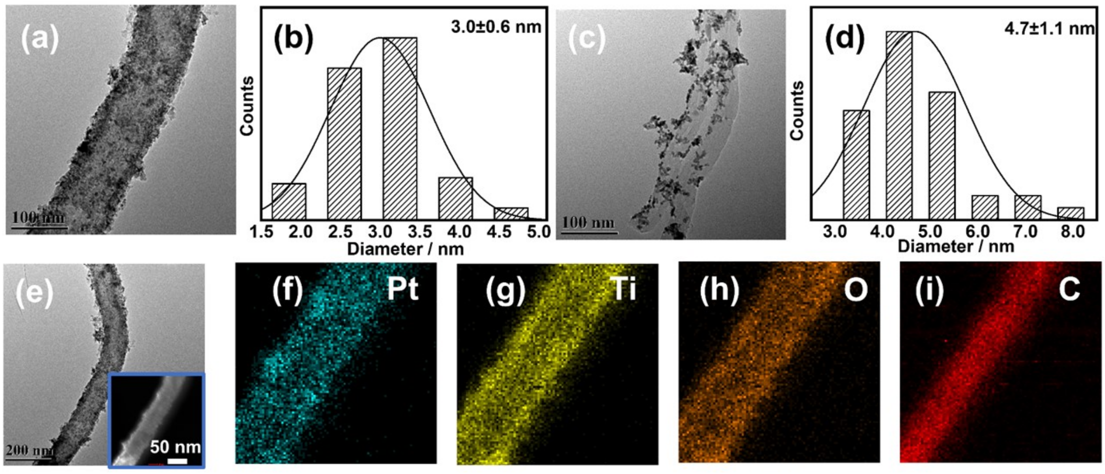

Fig. S8 TEM images of **(a)** Pt-TiO_2/CNT and **(c)** Pt/CNT after the glycerol oxidation reaction, with **(b, d)** corresponding size histograms of Pt particles. **(e)** TEM image and **(f-i)** the corresponding elemental mappings of Pt-TiO_2/CNT.

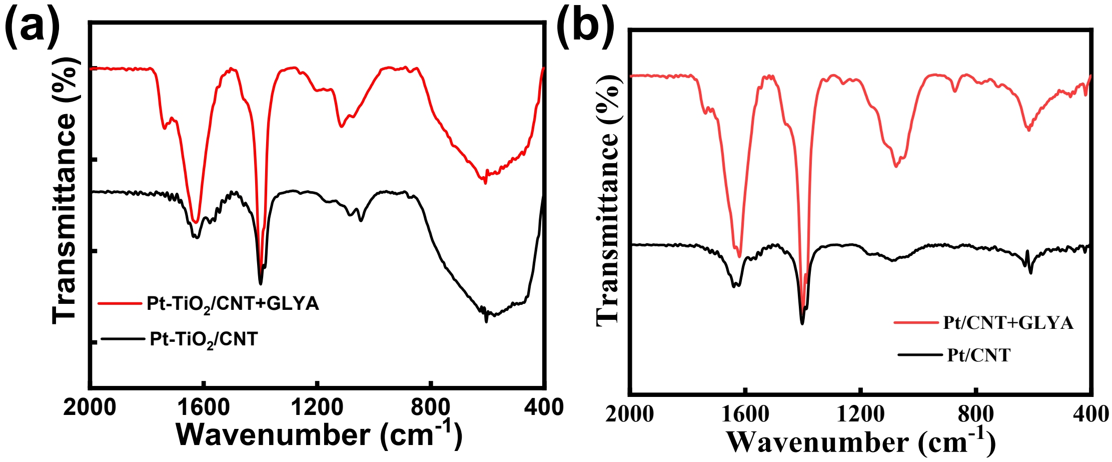

Fig. S9 IR spectra of the GLYA treated **(a)** Pt-TiO_2/CNT and **(b)** Pt/CNT

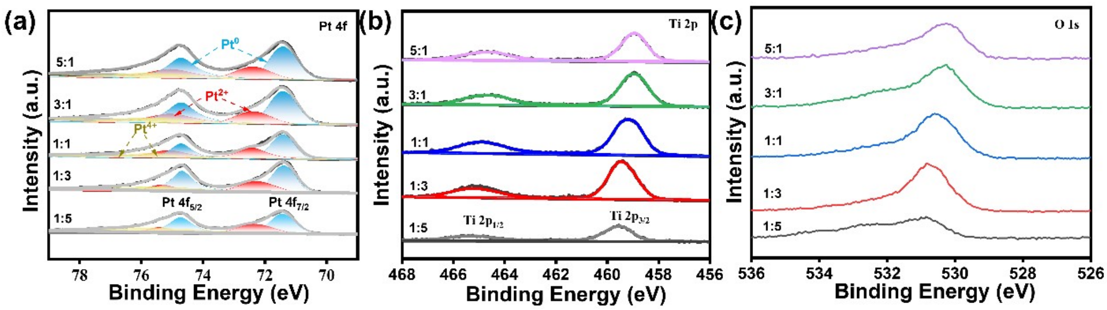

Fig. S10 XPS spectra of different catalysts. **(a)** Pt 4f, **(b)** Ti 2p, **(c)** O 1s.

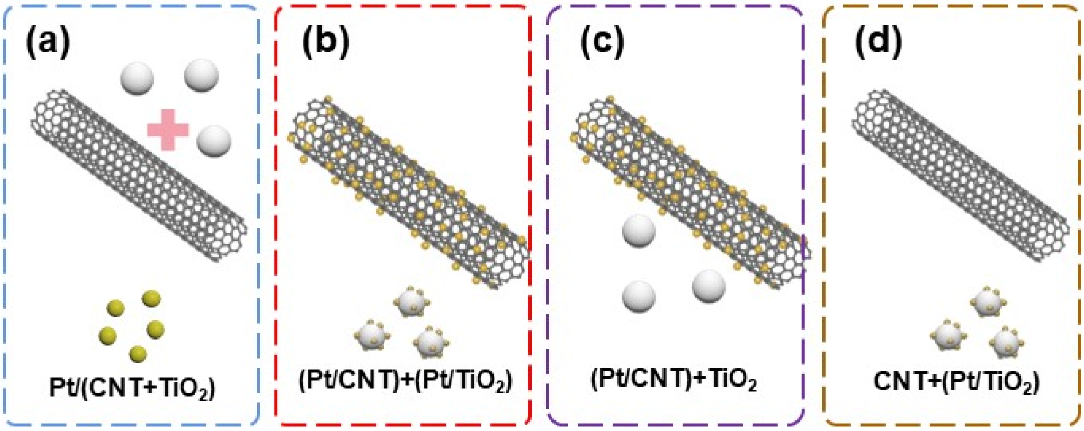

Fig. S11 Schematic diagram of catalysts with different combination of mechanical mixing. **(a)** TiO_2 and CNT are fully ground and mixed. **(b)** The Pt/CNT and Pt/TiO_2 are synthesized firstly, then Pt/CNT and Pt/TiO_2 are fully ground and mixed. **(c)** The Pt/CNT is synthesized firstly, then Pt/CNT and TiO_2 are fully ground and mixed. **(d)** The Pt/TiO_2 is synthesized firstly, then CNT and Pt/TiO_2 are fully ground and mixed

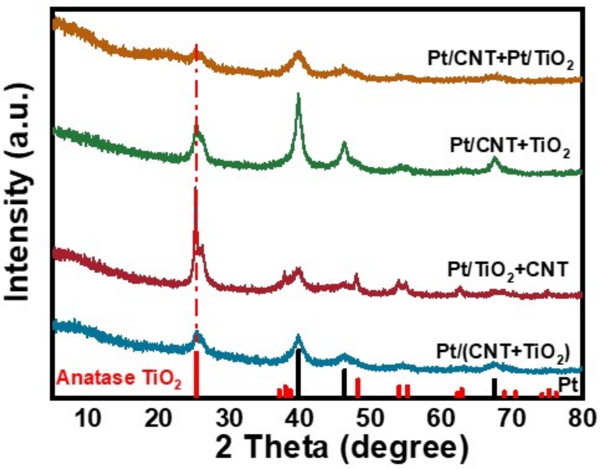

Fig. S12 XRD patterns of catalysts with different combination methods.

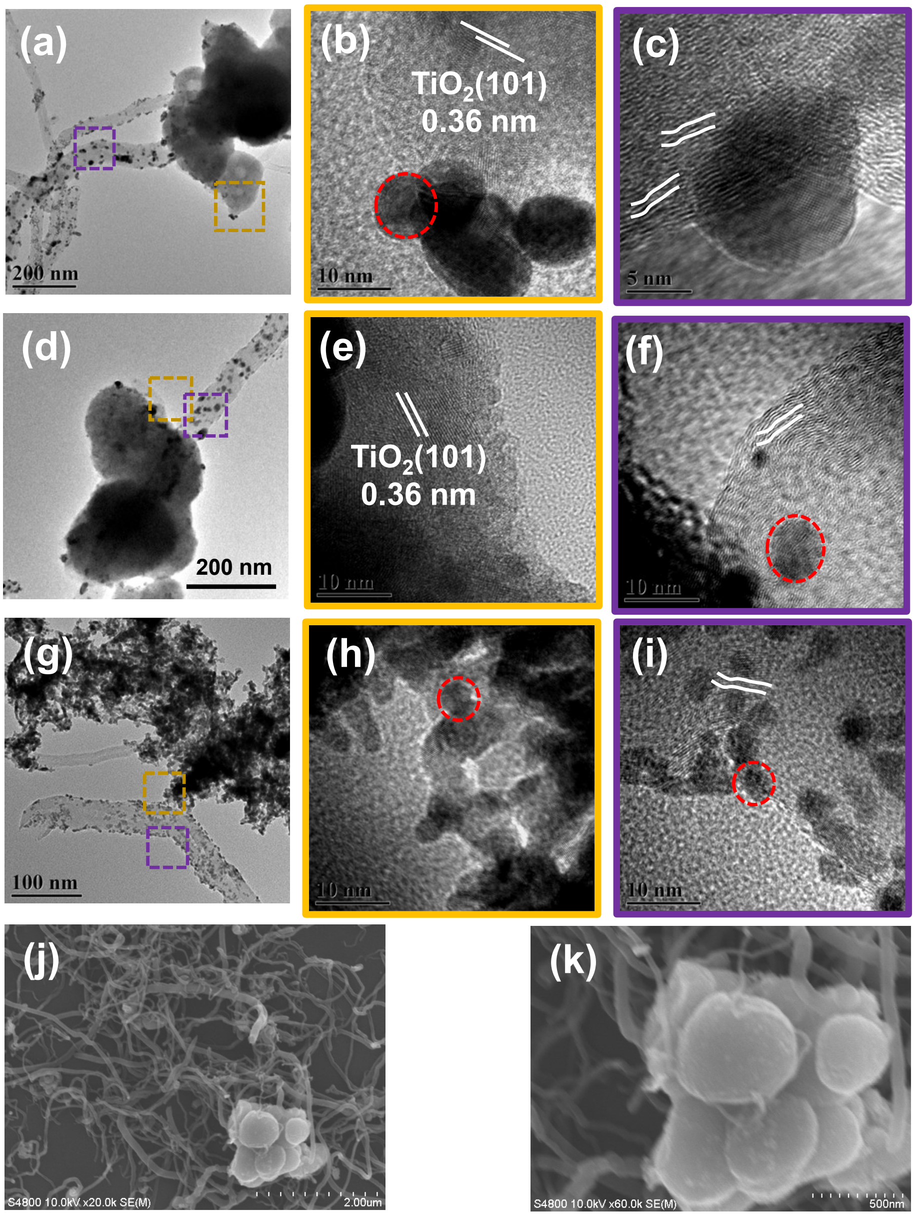

Fig. S13 TEM images of different combination catalysts with different magnification. **(a-c)** (Pt/CNT)+(Pt/TiO_2), **(d-f)** (Pt/CNT)+TiO_2, **(g-i)** Pt/(TiO_2+CNT), and **(j,k)** SEM images of (Pt/TiO_2)+CNT with different magnification. Note: The dotted boxes of different colors correspond to the solid boxes respectively.

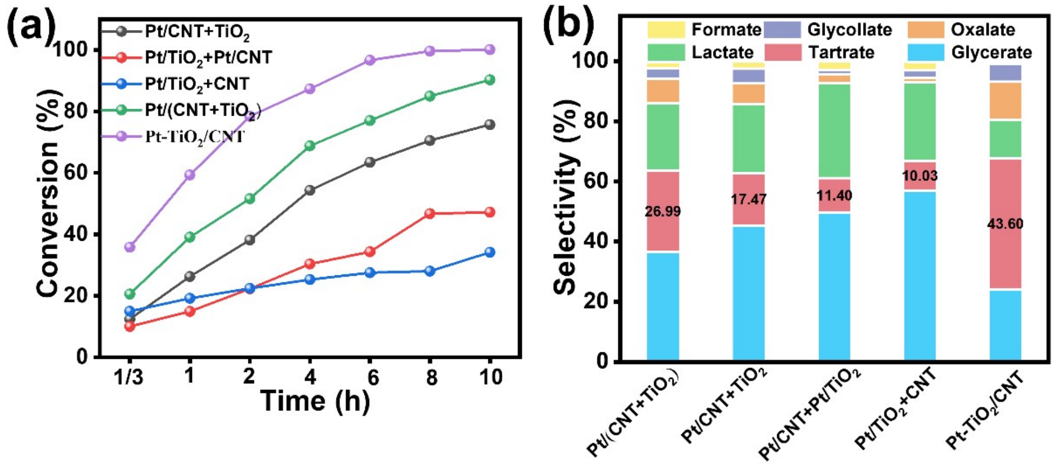

Fig. S14 Performance of different combination catalysts in glycerol oxidation. **(a)** The conversion of glycerol. **(b)** The selectivity of TAR after 10 h.

Table S1. ICP date of Pt-CNT and Pt-TiO_2/CNT

Sample	Pt%
Pt-CNT	18.9
Pt-TiO_2/CNT	18.8

Table S2. Glycerol oxidation over noble-metal catalysts

Catalyst	Electrolyte/Temperature	Potential/Time	Conv. (%)	Sel. of TAR. (%)	Ref.
Pt-TiO_2/CNT	0.1 M glycerol+1.0 M KOH, 60℃	0.8 V vs. RHE, 24h	~100	52.5	This work
Au-P4P/G	0.5 M glycerol +0.5 M KOH, RT*	0.1 V vs. Ag/AgCl, 2h	15	15	1
Au/C	2 M KOH+1 M glycerol,50 ℃	0.3 V,1h	7.2	19	2
RA-Au/Ni foam	1 M KOH+0.1 M glycerol	1.0 V vs.RHE,2h	68.7	10.8	3
CuAu/C	0.5 M glycerol +0.5 M KOH, RT	0.1 V vs. Ag/AgCl,2h	-	17.6	4
AuPt	0.5 M glycerol +1.0 M KOH, RT	0.9 V vs. RHE, 12h	55.1	13	5
Pt/C	0.1 M glycerol +2.0 M KOH, 60℃	0.3 V vs. SHE/AEM,2h	63.7	34	6
Pt/FeNC	0.1 M glycerol+1.0 M KOH,60 ℃	0.9 V vs. RHE,12h	100	50.8	7
Pt_9Bi/C	0.5 M glycerol +2.0 M KOH, RT	0.7 V vs.RHE,4h	-	10.9	8
Pt_2Rh_1/C	0.1 M glycerol +0.1 M$HClO_4$,60℃	0.45 V vs.SCE,8h	90	40.3	9
$Pt_{0.95}$-$Bi_{0.05}$/TiN/HNWs/CC	1 M KOH+0.05 M glycerol, RT	0.45 V vs.RHE,8h	87	14.1	10
Pd/CNT	5 wt% glycerol +2.0 M KOH,60℃	102 mA, 3.3h	15	15	11
Pd-(Ni-Zn)/C	2 M KOH+5wt% glycerol	20 mA/cm^2,10.2h	55.5	28.1	12
$PdAg_3$/CNT	1.0 M glycerol +4.0 M KOH,50℃	0.1 V vs.SHE, 2h	43	13.7	13
Au/C-NC	0.1 M glycerol+8.0 M KOH,60 ℃	＜0.45 V vs. RHE, 12h	89.2	69.3	14
Au/C	1 M glycerol+2 M KOH,60 ℃	0.4 V vs. RHE,19h	35	78	15

*: RT—Room Temperature

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