Supporting Information

Boosting activity and selectivity of glycerol oxidation over platinum-palladium-silver electrocatalysts via surface engineering

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Tables and Figures

Table S1. The electrochemical results of the $NH_3 \cdot H_2O$ and NaCl etched samples as determined from the LSV curves.

Sample	Alkaline solution			Acidic solution		
	E_{onset}[a]	I_{peak}[b]	E_{peak}[c]	E_{onset}	I_{peak}	E_{peak}
PtPd@Ag-NH_3	0.68	6.05	0.99	0.57	0.59	0.83
PtPd@Ag-NaCl	0.65	3.61	1.03	0.56	0.25	0.83
Pt@Ag-NH_3	0.53	1.78	1.02	0.65	0.26	0.83
Pt@Ag-NaCl	0.55	1.17	1.01	0.64	0.19	0.82
Pd@Ag-NH_3	0.75	1.33	1.00	/	/	/
Pd@Ag-NaCl	0.75	0.49	1.03	/	/	/
Pt/C	0.55	0.29	0.90	0.61	0.18	0.89

[a] E_{onset}: onset potential (unit: V); [b] I_{peak}: peak current density (unit: mA cm^{-2}) and [c] E_{peak}: peak potential (unit: V) determined from the LSV curves shown in **Fig. 3** and **Fig 4.**

Table S2. The electrochemical results of the $NH_3 \cdot H_2O$ and NaCl etched samples as determined from the CV curves.

Sample	Alkaline solution				Acidic solution			
	E_f[a]	I_f[b]	E_b[c]	I_b[d]	E_f	I_f	E_b	I_b
PtPd@Ag-NH_3	1.01	9.16	0.87	4.18	0.83	0.74	0.68	0.63
PtPd@Ag-NaCl	1.01	3.99	0.79	2.24	0.81	0.57	0.73	0.47
Pt@Ag-NH_3	1.01	2.65	1.00	1.90	0.84	0.44	0.66	0.35
Pt@Ag-NaCl	1.03	1.21	0.93	0.90	0.84	0.36	0.65	0.28
Pd@Ag-NH_3	1.02	1.34	0.80	0.71	/	/	/	/
Pd@Ag-NaCl	1.05	0.69	0.81	0.36	/	/	/	/
Pt/C	1.01	0.49	1.02	0.22	0.96	0.32	0.66	0.21

[a] E_f: peak potential (unit: V) at the forward scan; [b] I_f: maximum current densities (unit: mA cm^{-2}) at the forward scan; [c] E_b: peak potential (unit: V) at the backward scan; [d] I_b: maximum current densities (unit: mA cm^{-2}) at the backward scan.

Table S3 Product concentrations of GLY oxidation under an applied potential of 0.5 V. (unit: mg/L)

Catalysts	OA	TA	GLOA	GLA	GALD	GA	DHA
PtPd@Ag-NH_3	3.82	0	0.21	3.11	15.98	0	52.39
PtPd@Ag-NaCl	3.96	0.06	0.03	5.20	22.09	0	30.20
Pt@Ag-NH_3	14.76	0.54	0	119.65	61.77	0	47.20
Pt@Ag-NaCl	5.71	0	0	2.17	6.80	0	47.53
Pd@Ag-NH_3	3.69	0	0.09	2.07	13.64	0	30.72
Pd@Ag-NaCl	3.59	0	0.04	3.61	18.79	0	31.37
Pt/C	3.45	0	0.15	7.04	7.23	10.93	30.31
Pd/C	4.00	0	0	3.03	13.20	0	30.57

Table S4 Product concentrations of GLY oxidation under an applied potential of 0.7 V. (unit: mg/L)

Catalysts	OA	TA	GLOA	GLA	GALD	GA	DHA
PtPd@Ag-NH_3	3.57	0	0.07	5.00	15.68	0	30.34
PtPd@Ag-NaCl	3.52	0.05	0.04	6.67	17.63	0	30.11
Pt@Ag-NH_3	11.18	0	0	3.78	8.41	0	51.26
Pt@Ag-NaCl	5.39	0.32	0	14.73	3.95	0	28.73
Pd@Ag-NH_3	3.70	0.14	0.06	3.29	15.79	0	30.94
Pd@Ag-NaCl	3.29	0	0	4.09	18.50	0	32.01
Pt/C	3.61	0.36	0.65	15.96	9.13	12.60	30.68
Pd/C	3.69	0	0	3.29	12.85	0	30.22

Table S5 Product concentrations of GLY oxidation under an applied potential of 0.9 V. (unit: mg/L)

Catalysts	OA	TA	GLOA	GLA	GALD	GA	DHA
PtPd@Ag-NH_3	3.58	0	0	9.73	19.44	0	27.47
PtPd@Ag-NaCl	3.52	0.02	0.10	10.21	17.22	0	29.61
Pt@Ag-NH_3	8.18	0.09	0	5.38	10.19	0	30.34
Pt@Ag-NaCl	4.93	0	0	6.63	10.90	0	49.44
Pd@Ag-NH_3	3.77	0	0	7.46	18.55	0	28.22
Pd@Ag-NaCl	3.17	0	0	4.48	16.23	0	30.85
Pt/C	5.35	1.04	0.34	35.11	0	11.18	30.08
Pd/C	3.44	0	0	4.04	15.32	0	31.78

Table S6 Product concentrations of GLY oxidation under an applied potential of 1.1 V. (unit: mg/L)

Catalysts	OA	TA	GLOA	GLA	GALD	GA	DHA
PtPd@Ag-NH_3	3.64	0	0.07	6.59	18.01	0	27.76
PtPd@Ag-NaCl	6.00	0.03	0.12	6.96	19.79	0	31.00
Pt@Ag-NH_3	6.76	0.11	0	5.20	12.03	0	51.45
Pt@Ag-NaCl	4.85	0	0	10.74	14.45	0	49.40
Pd@Ag-NH_3	3.30	0	0.03	4.63	4.56	8.95	27.20
Pd@Ag-NaCl	3.24	0	0.05	4.32	15.19	0	32.04
Pt/C	5.40	0.33	0.10	22.05	8.21	12.07	28.43
Pd/C	3.25	0.01	0.06	5.01	16.43	0	30.93

Table S7 Product concentrations of GLY oxidation under an applied potential of 1.3 V. (unit: mg/L)

Catalysts	OA	TA	GLOA	GLA	GALD	GA	DHA
PtPd@Ag-NH_3	3.58	0	0.07	5.53	17.39	0	28.00
PtPd@Ag-NaCl	4.98	0	0	3.86	17.27	0	30.42
Pt@Ag-NH_3	6.25	0	0	5.75	12.74	0	48.83
Pt@Ag-NaCl	4.36	0.01	0.07	3.09	6.44	0	51.14
Pd@Ag-NH_3	4.24	0.05	0.04	2.50	5.91	0	28.08
Pd@Ag-NaCl	4.07	0	0	3.24	13.68	0	33.20
Pt/C	4.75	0	0.13	12.30	6.64	12.71	29.53
Pd/C	3.67	0	0.11	1.98	6.10	0	29.69

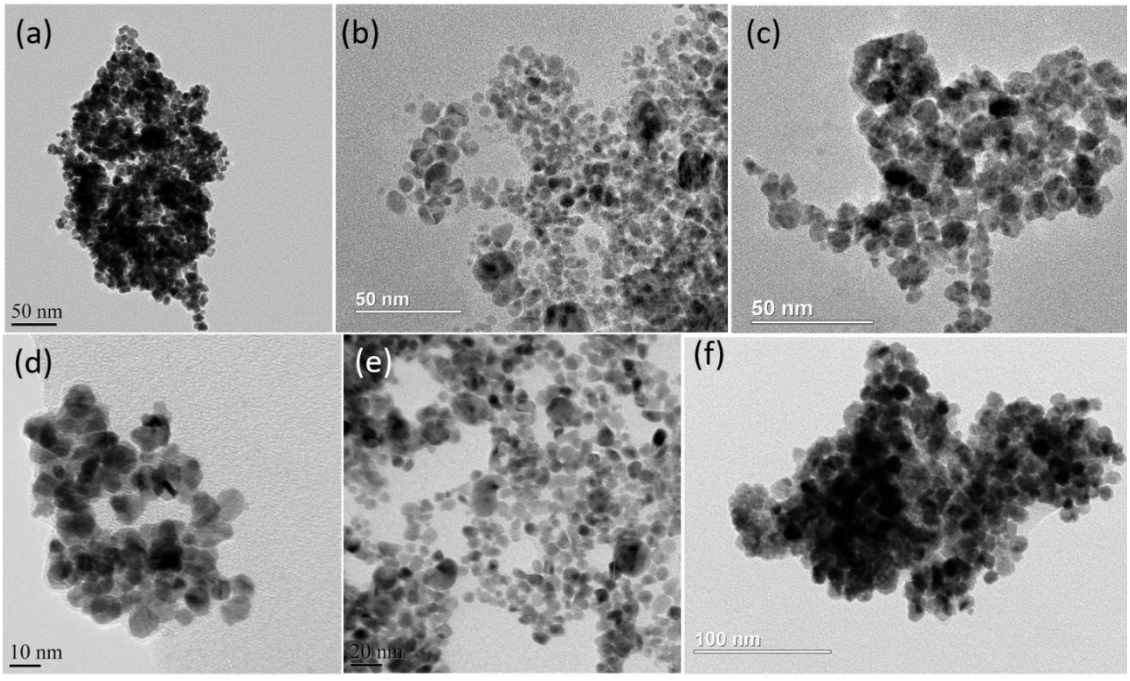

Fig. S1. (a), (b), (c), (d), (e) and (f) TEM images of the Pt@Ag-NaCl, Pd@Ag-NaCl, PtPd@Ag-NaCl, Pt@Ag-NH_3, Pd@Ag-NH_3, and PtPd@Ag-NH_3 NPs, respectively.

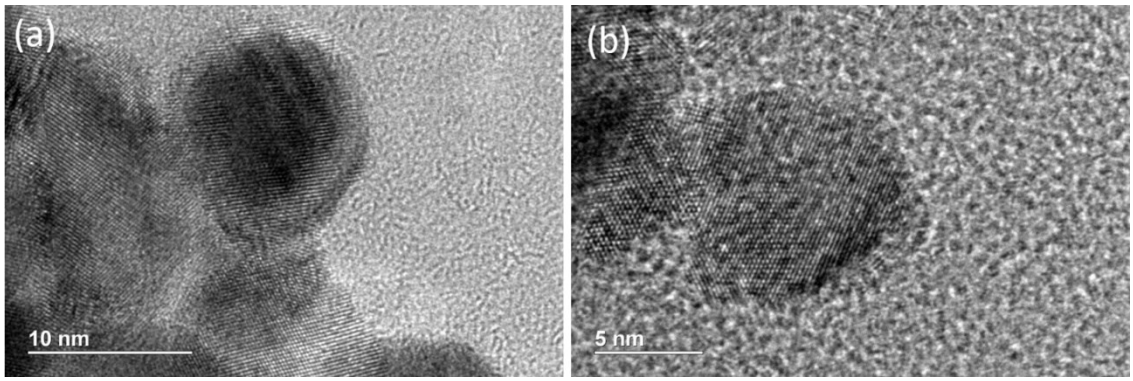

Fig. S2. (a) and (b) HR-TEM images of the PtPd@Ag-NaCl NPs.

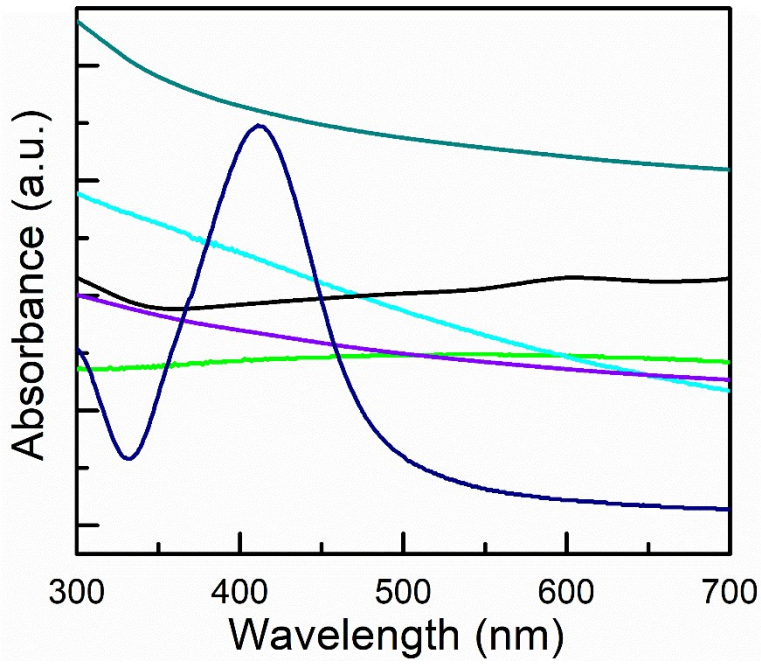

Fig. S3. UV–vis absorption spectra of the samples. Black: PtPd@Ag-NH_3; Green: Pt@Ag-NH_3; Cyan: Pd@Ag-NH_3; Dark cyan: Pt/C; Violet: Pd/C; and Navy: Ag

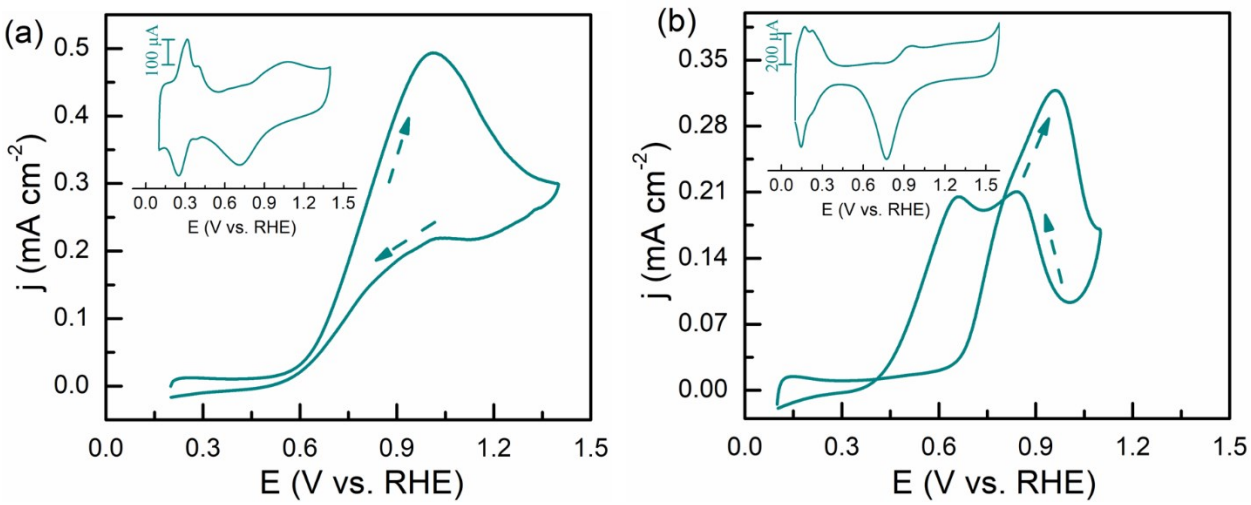

Fig. S4. Voltammograms of Pt/C NPs recorded in (a) 0.1 M KOH + 1 M GLY and (b) 0.1 M $HClO_4$ + 1 M GLY with a scan rate of 50 mV/s. The insets are the corresponding voltammograms recorded in 1 M KOH or 1 M $HClO_4$.

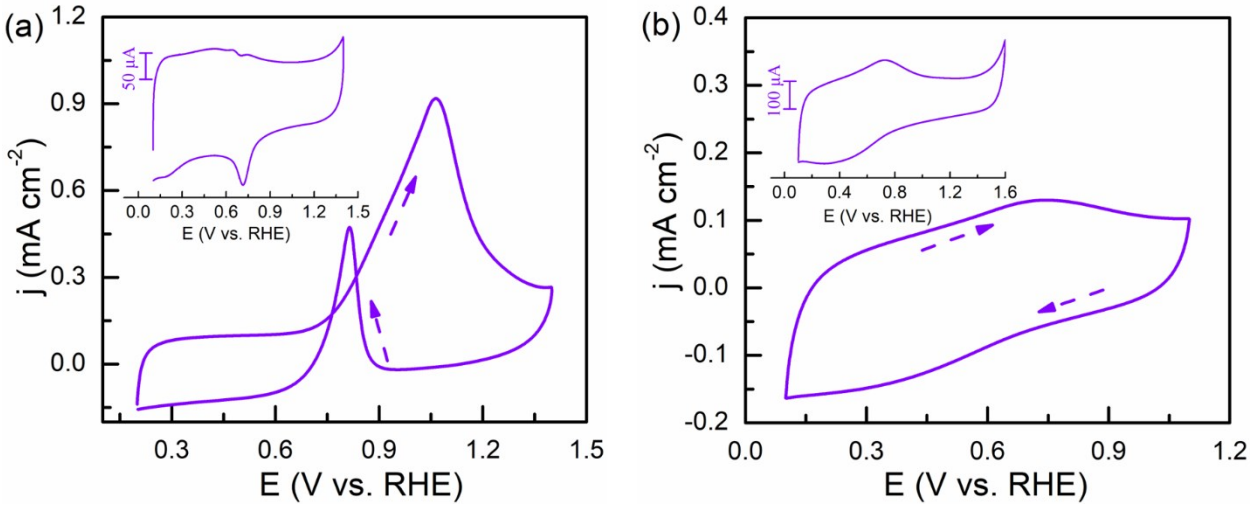

Fig. S5. Voltammograms of Pd/C NPs recorded in (a) 0.1 M KOH + 1 M GLY and (b) 0.1 M $HClO_4$ + 1 M GLY with a scan rate of 50 mV/s. The insets are the corresponding voltammograms recorded in 1 M KOH or 1 M $HClO_4$.

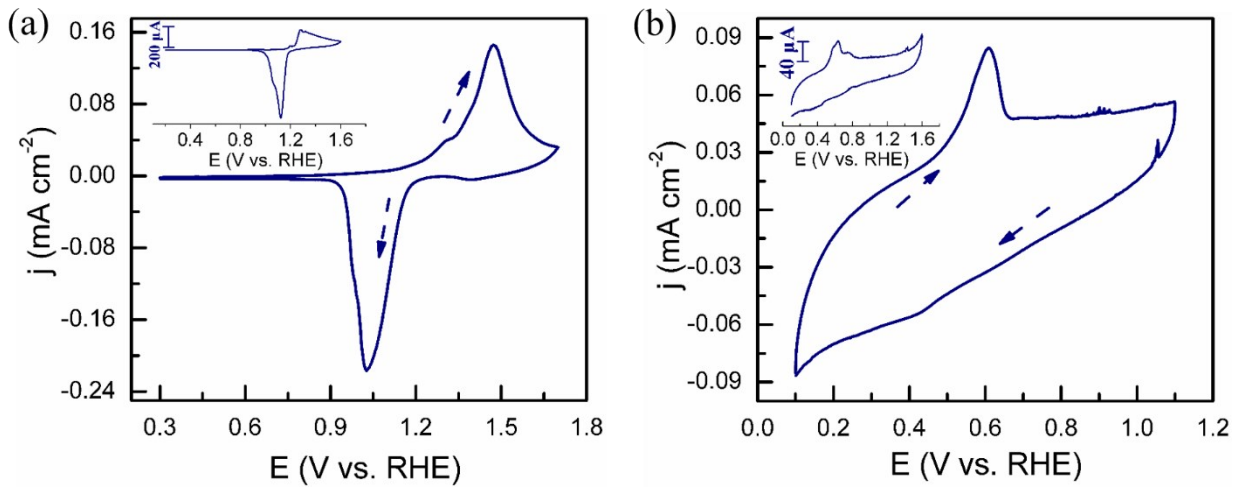

Fig. S6. Voltammograms of Ag NPs recorded in (a) 0.1 M KOH + 1 M GLY and (b) 0.1 M $HClO_4$ + 1 M GLY with a scan rate of 50 mV/s. The insets are the corresponding voltammograms recorded in 1 M KOH or 1 M $HClO_4$.

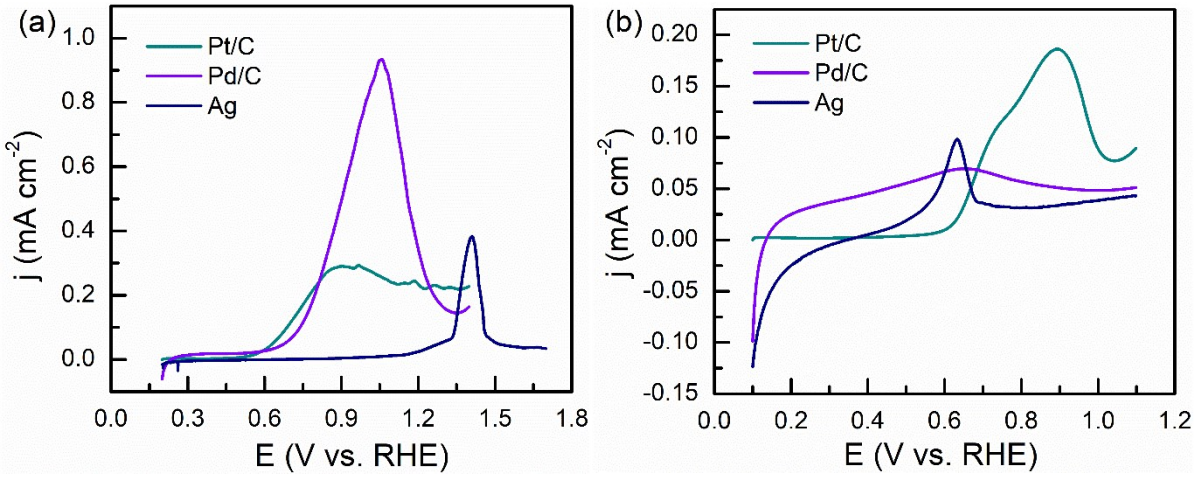

Fig. S7. LSV curves of GLY oxidation recorded with a scan rate of 10 mV s^{-1} in a solution of (a) 0.1 M KOH + 1 M GLY and (b) 0.1 M $HClO_4$ + 1 M GLY.

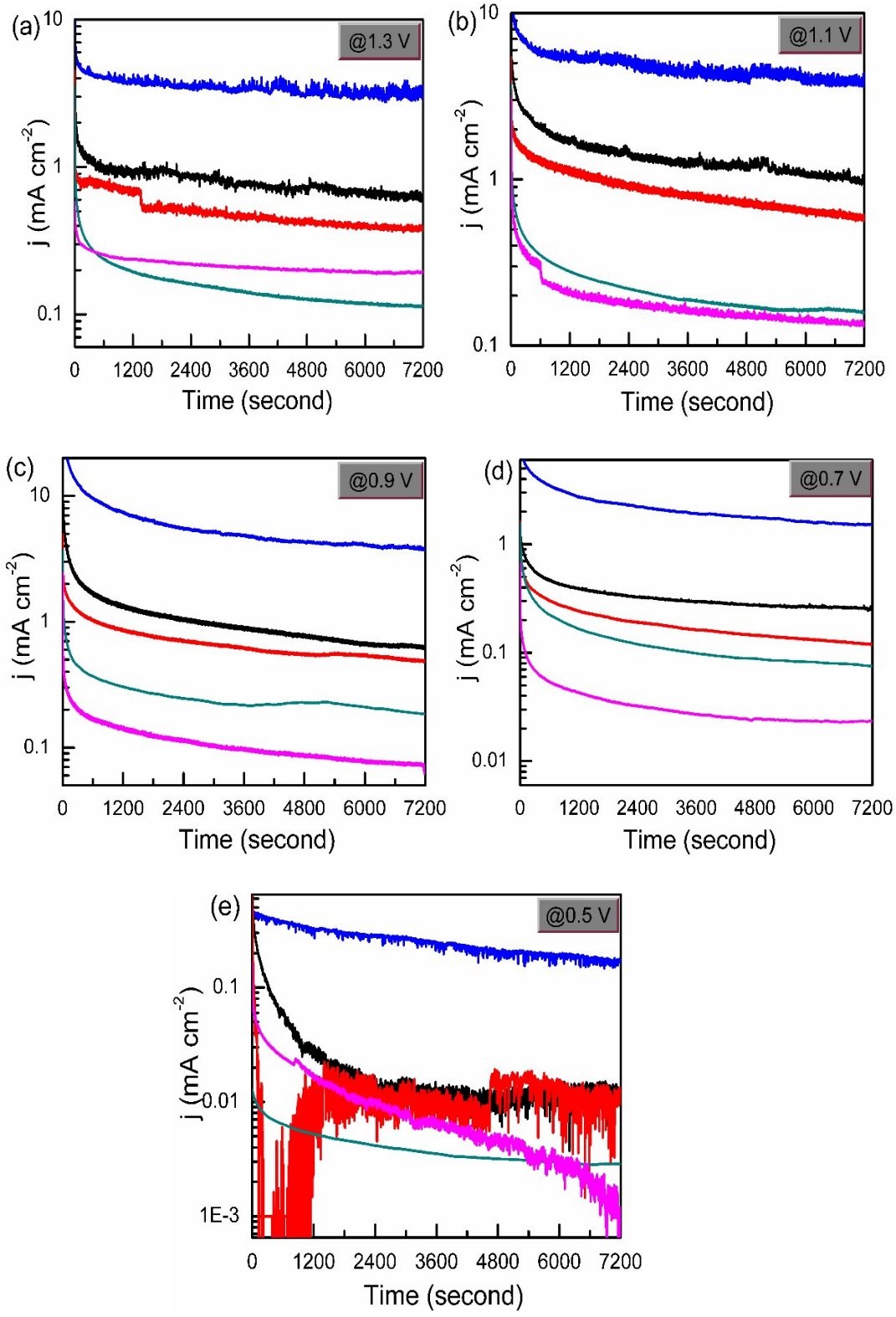

Fig. S8. i-t curves of GLY oxidation in 0.5 M KOH and 0.5 M GLY under different potentials: Blue: PtPd@Ag-NH_3; Black: Pt@Ag-NH_3; Red: Pd@Ag-NH_3; Dark Cyan: Pt/C; and Magenta: Pd/C

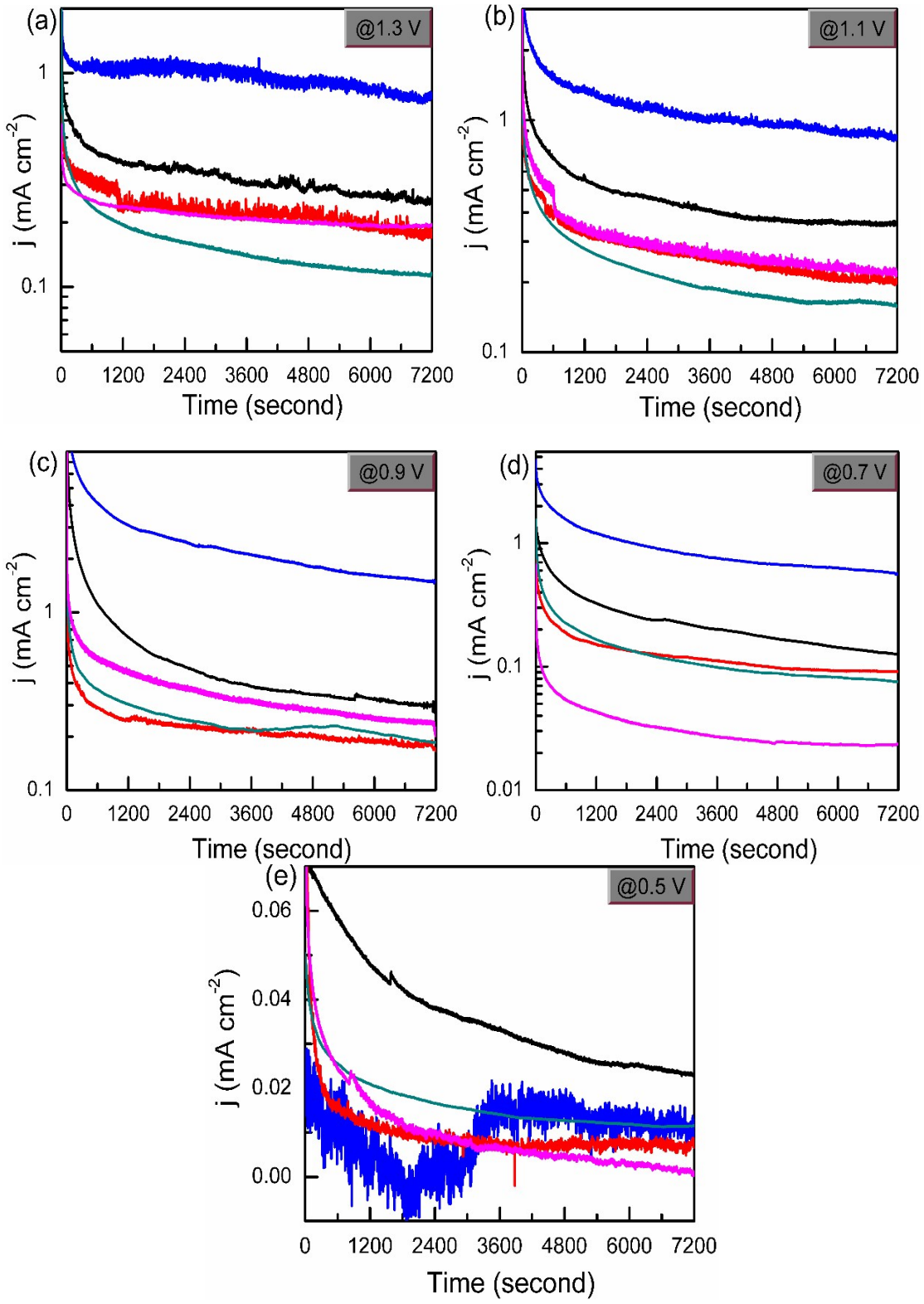

Fig. S9. i-t curves of GLY oxidation in 0.5 M KOH and 0.5 M GLY under different potentials: Blue: PtPd@Ag-NaCl; Black: Pt@Ag-NaCl; Red: Pd@Ag-NaCl; Dark Cyan: Pt/C; and Magenta: Pd/C

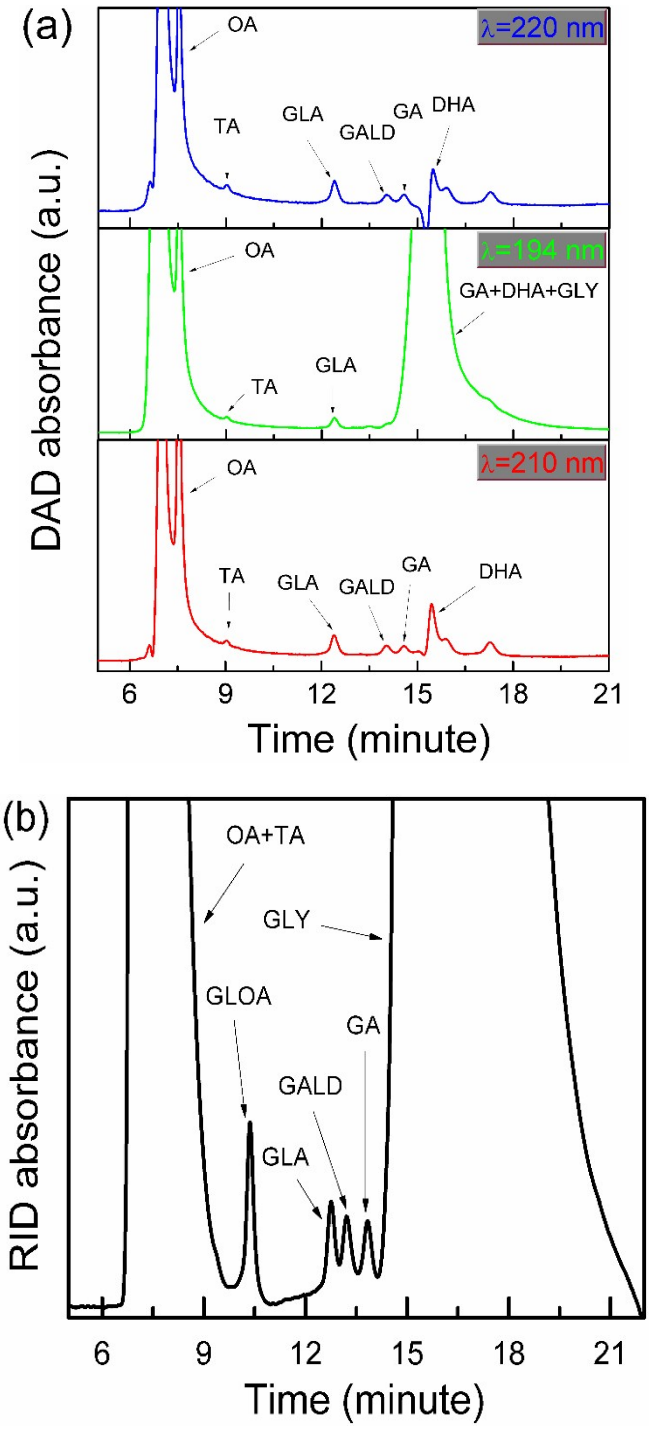

Fig. S10. Representative HPLC curves recorded from (a) DAD and (b) RID detectors.