Supporting Information

Self-stabilized Pt-Rh bimetallic nanoclusters as durable electrocatalyst for dioxygen reduction in PEM fuel cells

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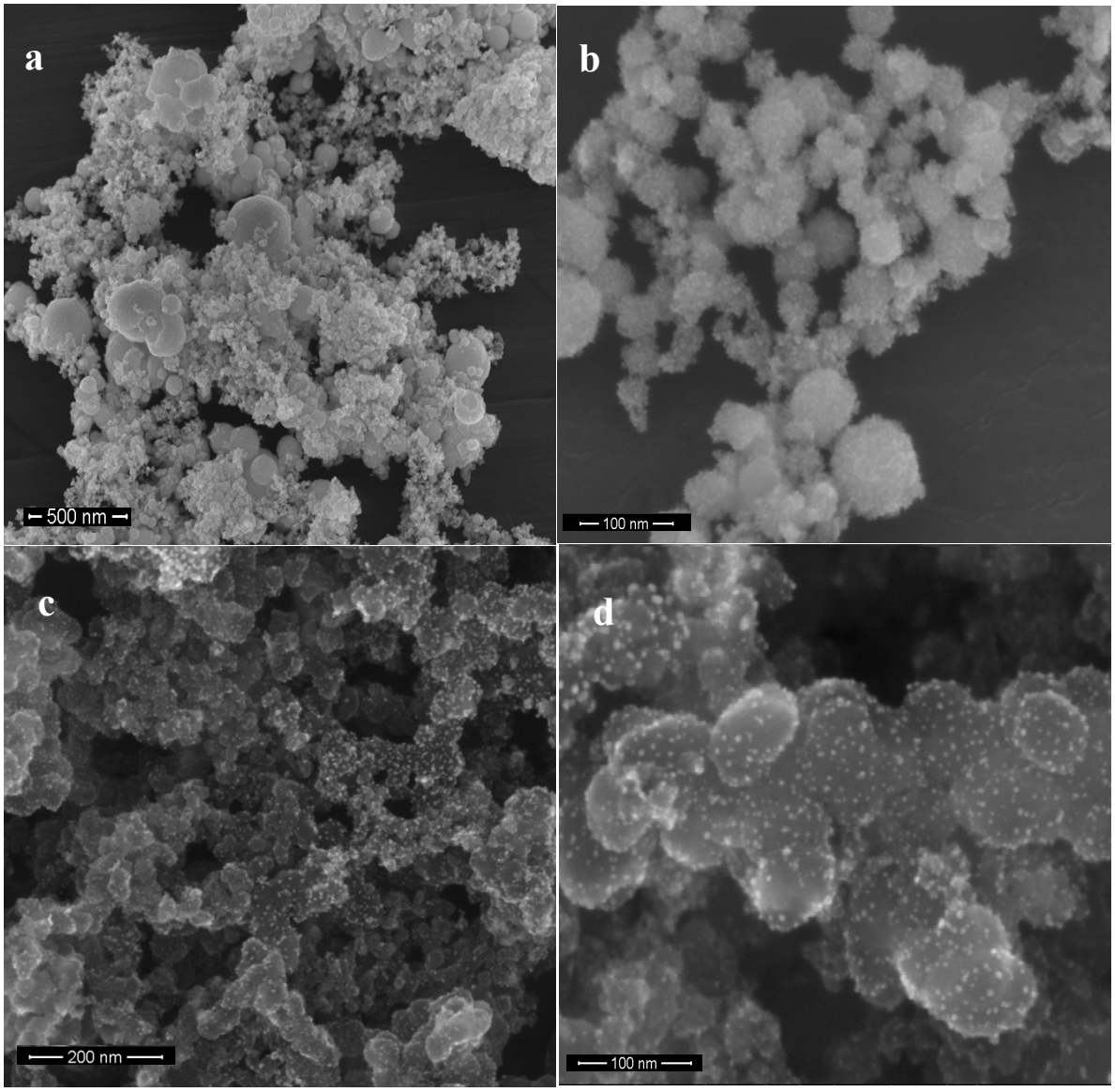

Figure S1. FESEM images of supportless nanoclusters of SL Pt_3Rh NC (a & b) and VC supported Pt_3Rh NC (c & d).

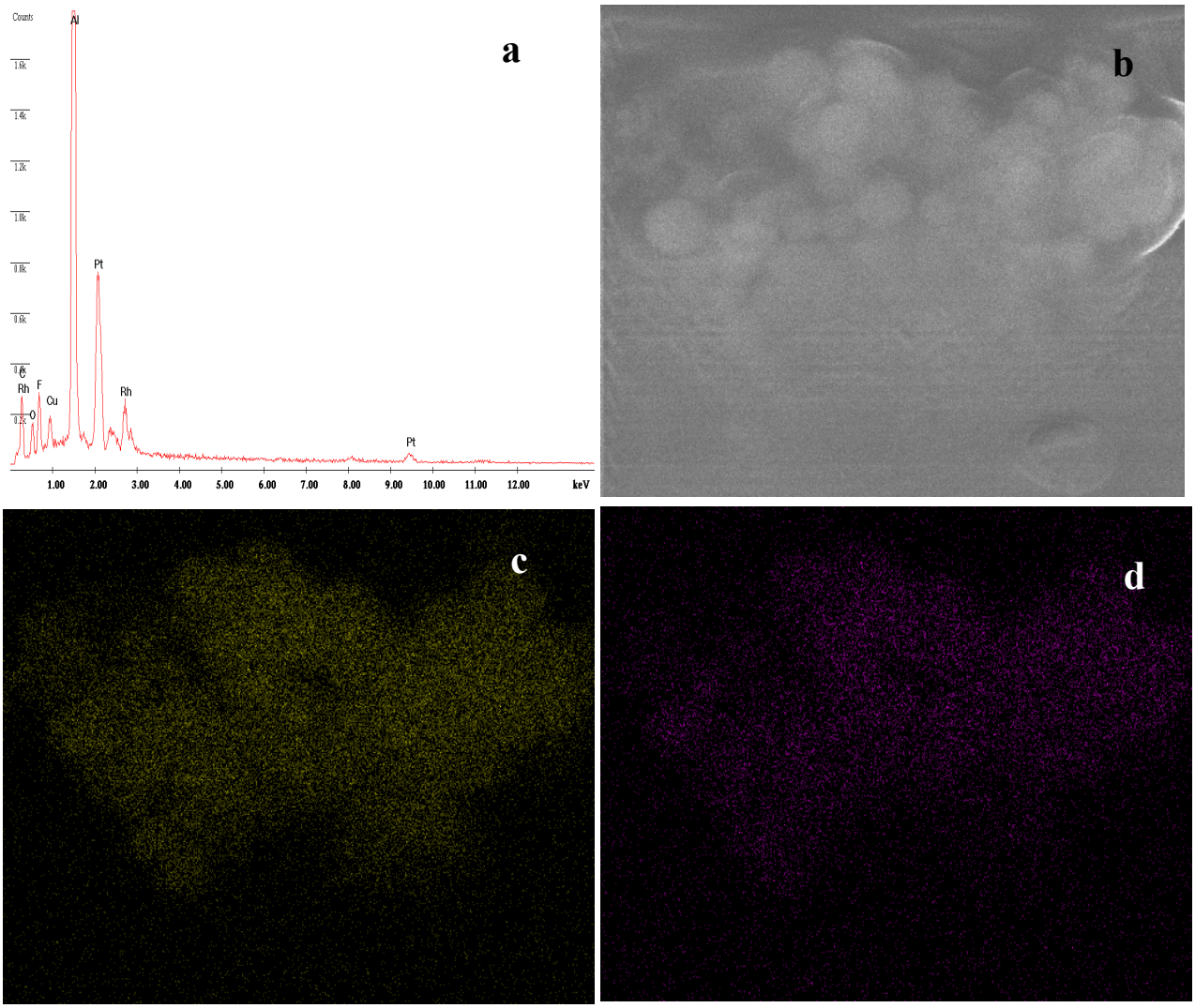

Figure S2. (a) EDX pattern, (b) SEM and elemental mappings of (c) Pt, (d) Rh for supportless Pt_3Rh nanoclusters.

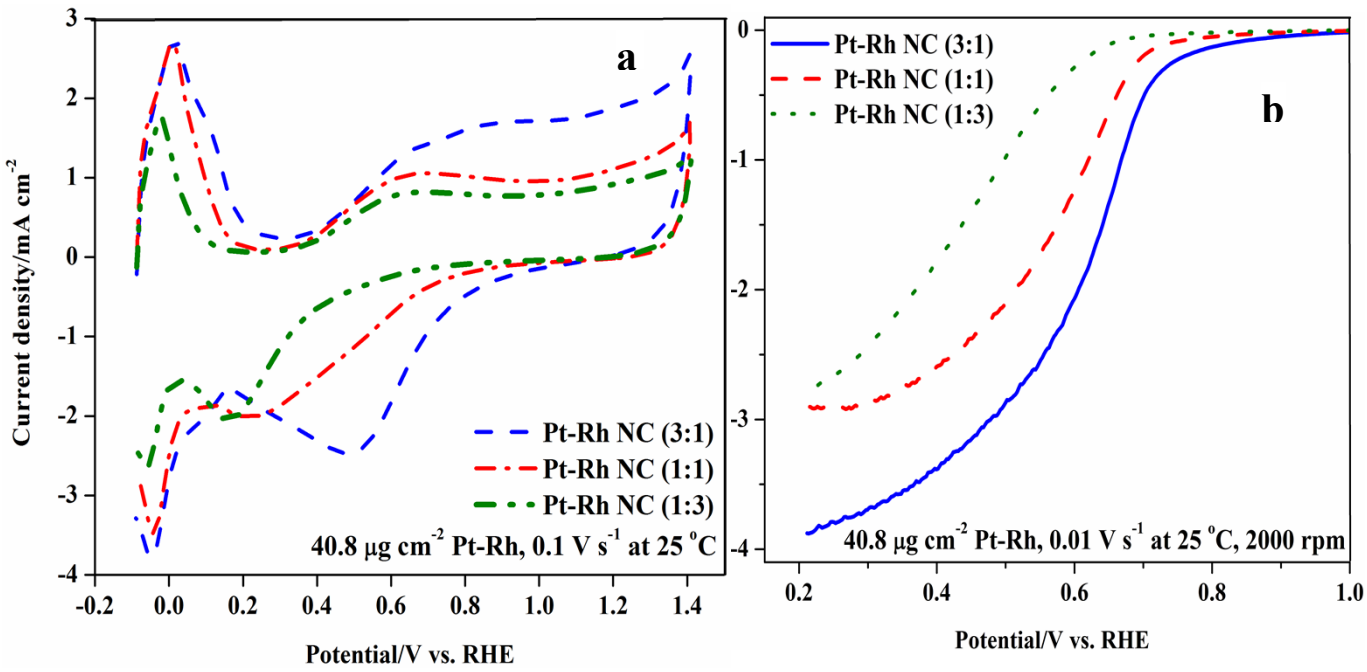

Figure S3. Comparison of (a) cyclic voltammograms in N_2 and (b) linear scan voltammograms in O_2 saturated 0.5 M H_2SO_4 for SL Pt-Rh nanoclusters with different atomic wt. % compositions at 25 °C.

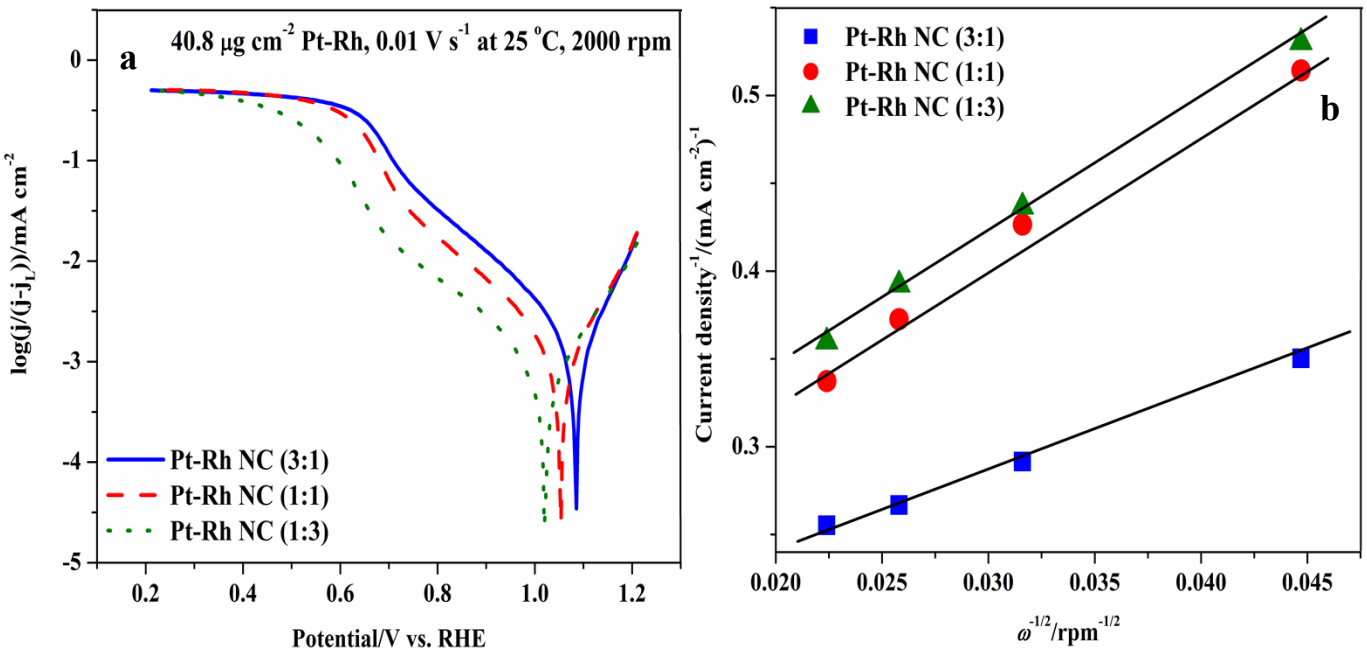

Figure S4. Comparison of (a) mass transfer corrected Tafel plots and (b) K-L plots of SL Pt-Rh nanoclusters with different atomic wt. % compositions in O_2 saturated 0.5 M H_2SO_4 at a scan rate of 0.01 V s^{-1} at 25 °C.

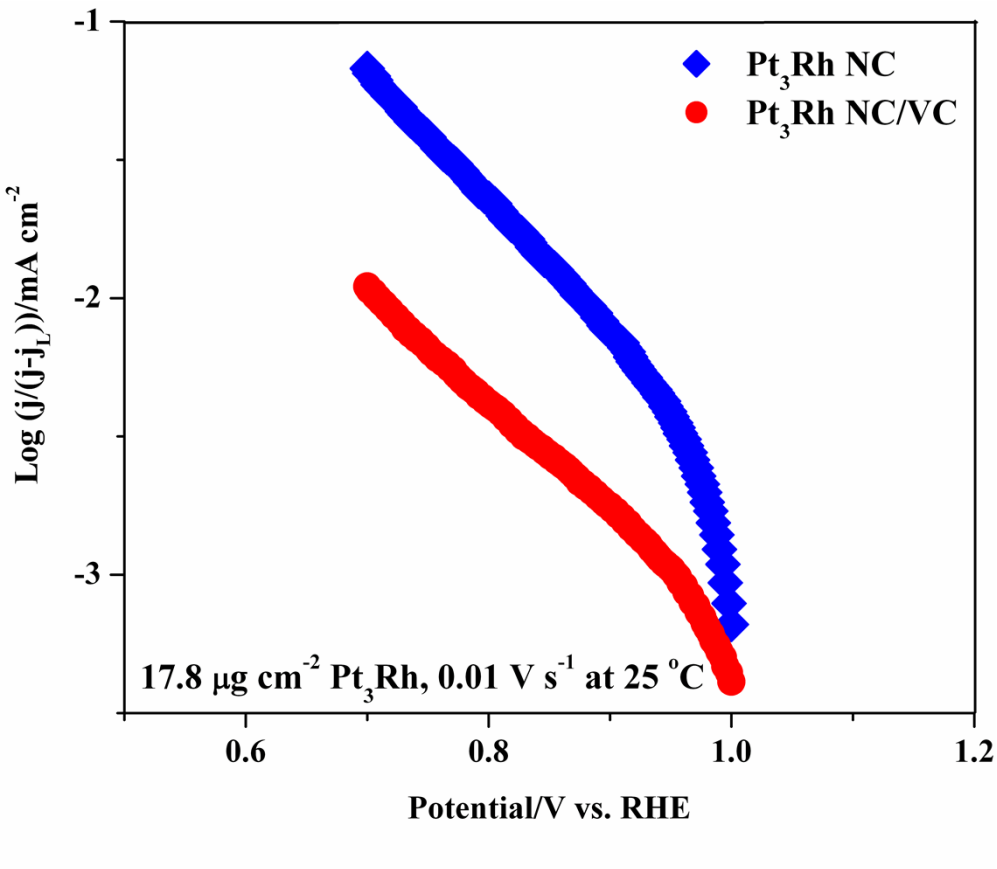

Figure S5. Mass transfer corrected Tafel plots of supportless Pt_3Rh and Pt_3Rh/VC nanoclusters in O_2 saturated 0.5 M H_2SO_4 at 2400 rpm at a scan rate of 0.01 V s^{-1} at 25 °C.

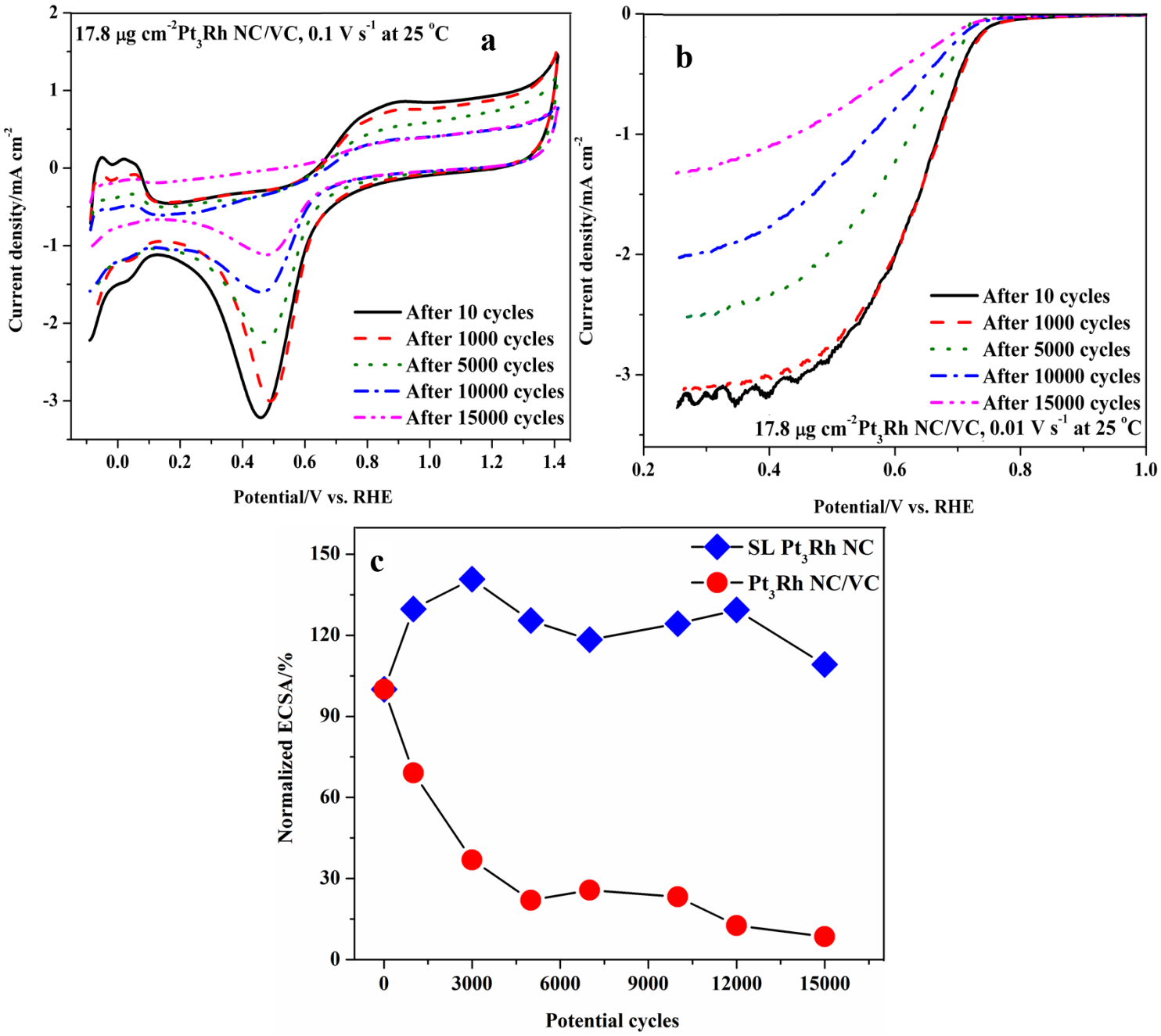

Figure S6. ADT (a) CVs and (b) LSVs of Pt_3Rh/VC nanoclusters and (c) comparison of normalized ECSA for both supportless and VC supported Pt_3Rh nanoclusters during potential cycling.

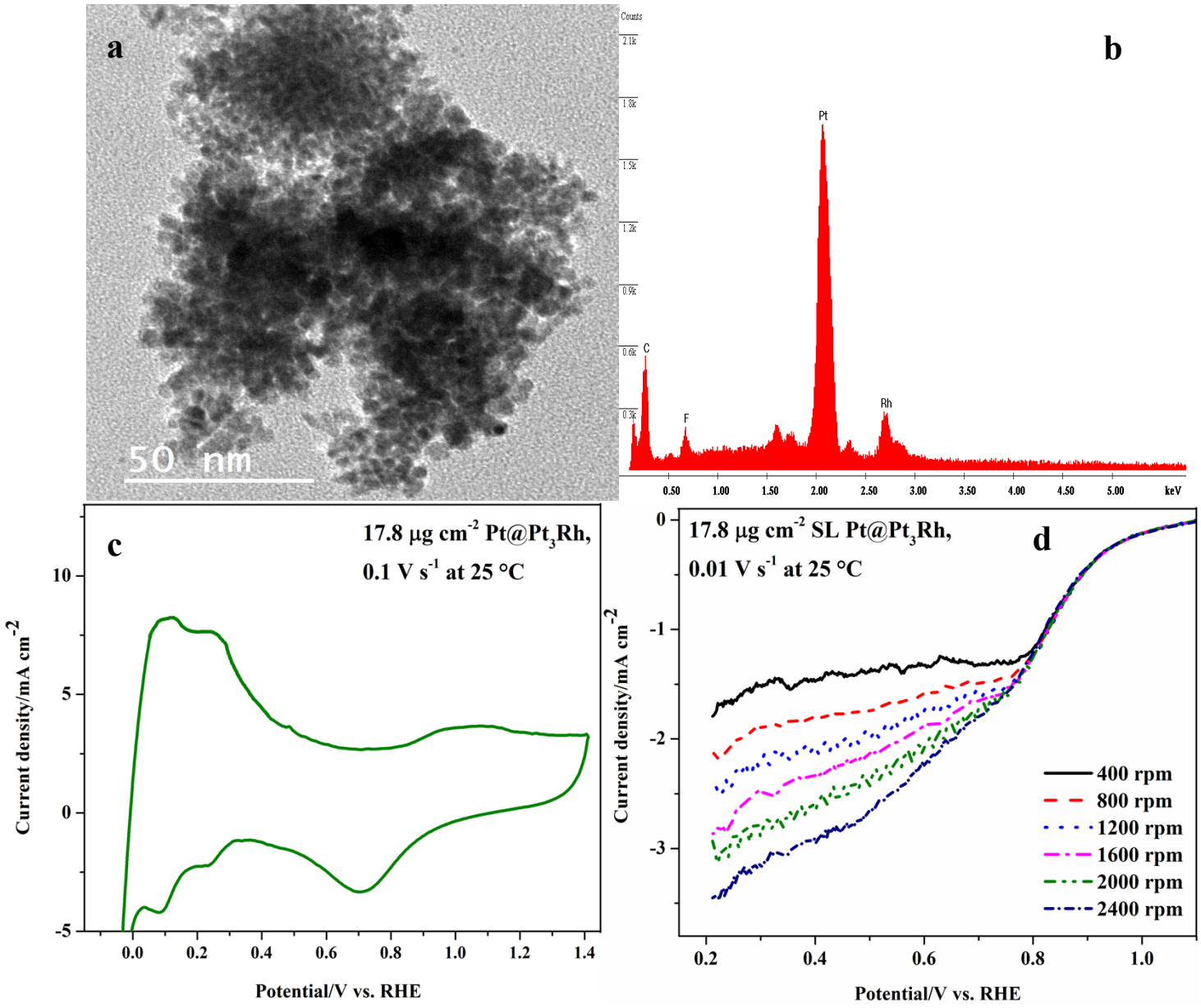

Figure S7. (a) TEM image, (b) EDX pattern, (c) CV in N_2 and (d) LSVs at different rotation rates in O_2 saturated 0.5 M H_2SO_4 for SL Pt@Pt_3Rh nanoclusters at 25 °C.

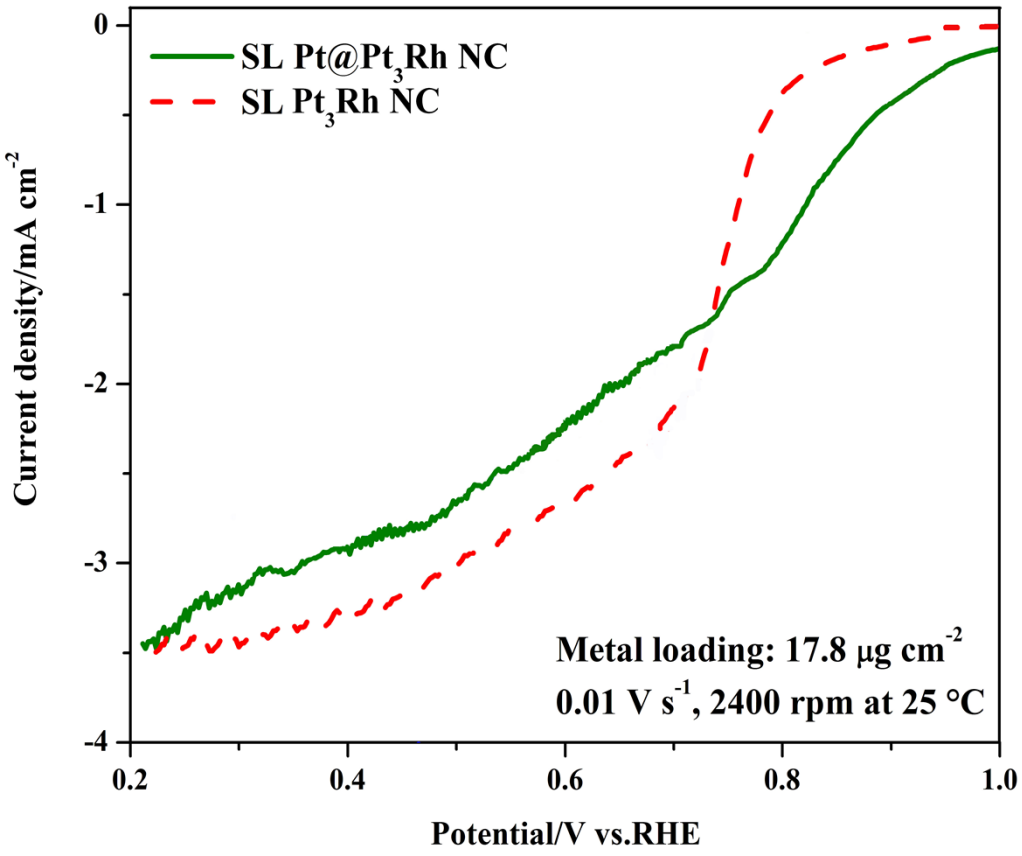

Figure S8. Comparison of LSVs for supportless Pt@Pt_3Rh and Pt_3Rh nanoclusters at rotation rate of 2400 rpm in O_2 saturated 0.5 M H_2SO_4 nanoclusters at 25 °C.

Table S1. Comparison of ORR kinetic parameters for supportless Pt-Rh nanoclusters with different atomic weight percentage composition.

Pt-Rh (atomic wt. % composition)	j_d **(mA cm^{-2})**	**Onset Potential (V)**	b **(mV dec^{-1})**	$E_{1/2}$ **(V)**	$10^6 * i_0$ **(A cm^{-2})**	n
3:1	3.92	0.73	132	0.61	1.30	4.0
1:1	2.96	0.68	143	0.57	0.57	2.65
1:3	2.78	0.59	159	0.45	0.35	2.61

j_d-limiting current density; $E_{1/2}$-half-wave potential; b-Tafel slope; α-electron transfer coefficient; i_0-exchange current density; n-number of electron transfer.