Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Core-Shell Pd-P@Pt-Ni Nanoparticles with Enhanced Activity and Durability as Anode Electrocatalyst for Methanol Oxidation Reaction

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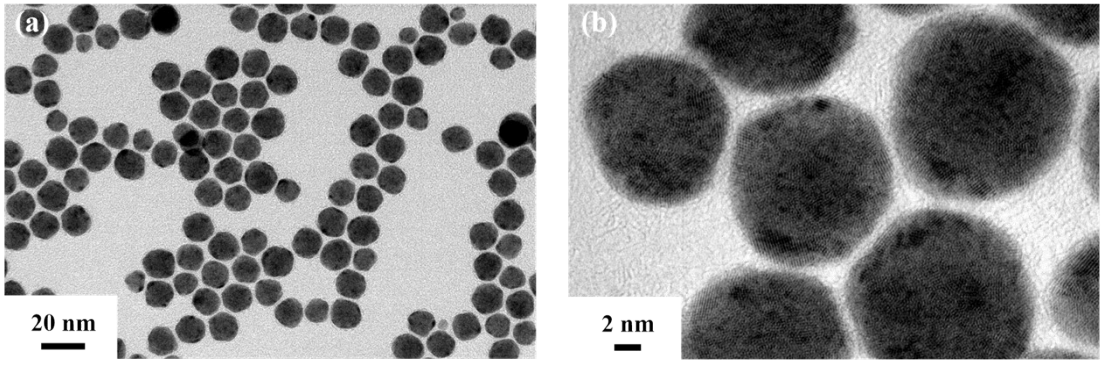

Figure S1. (a) Representative TEM and (b) HRTEM images of Pd-P@Pt-Ni NPs.

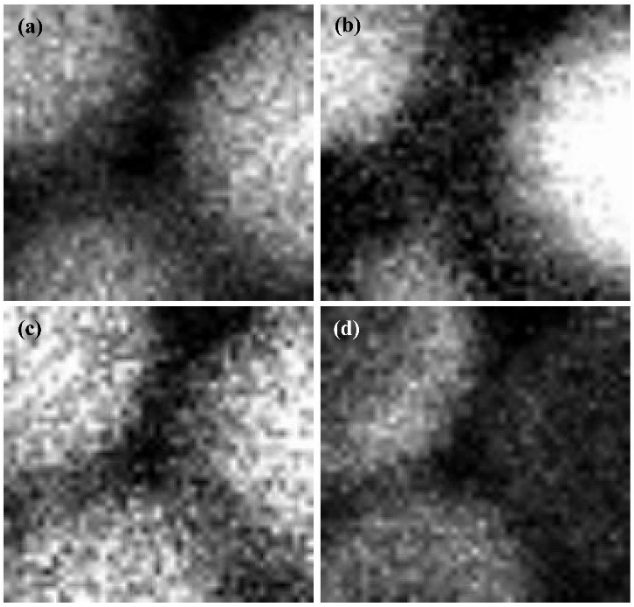

Figure S2. STEM-EDS images of (a) Pd, (b) P, (c) Ni and (d) Pt in Pd-P@Pt-Ni NPs.

Table S1. The amounts of $Pt(acac)_2$ and OAm corresponding to the TEM images in Figure S3.

Sample	$Pt(acac)_2$/mmol	OAm/mL	TEM image
1	0.20	10	Figure S3(a)
2	0.15	10	Figure S3(b)
3	0.10	10	Figure S3(c)
4	0.20	17	Figure S3(d)
5	0.15	17	Figure S3(e)
6	0.13	17	Figure S3(f)

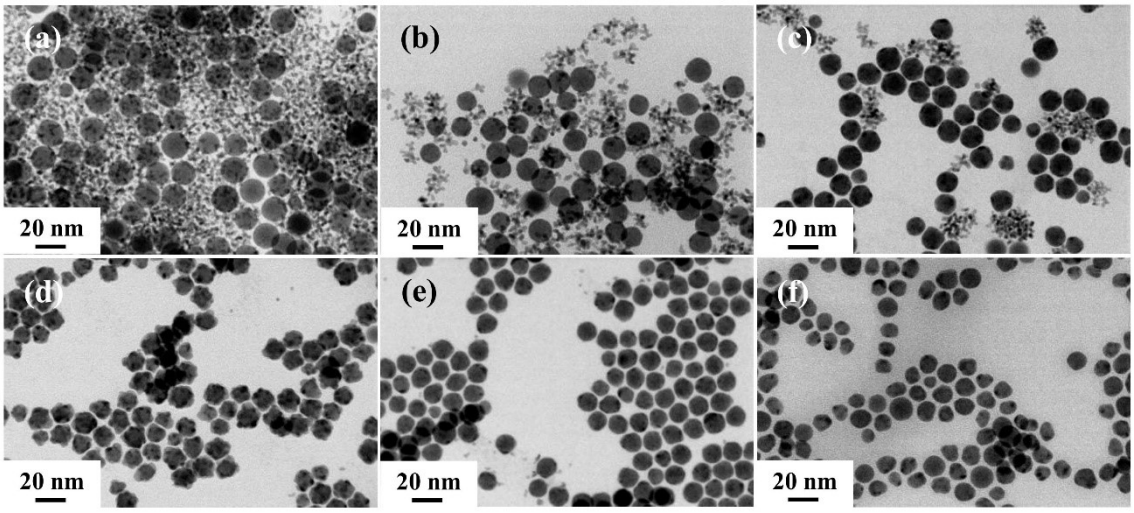

Figure S3. TEM images of products fabricated with different amounts of $Pt(acac)_2$ and OAm. The detailed information is summarized in Table S1.

Table S2. Peak position (2θ), *d*-spacing and lattice parameter collected from XRD data.

materials	plane (111)			plane (220)	
	2θ (degree)	*d*-spacing (nm)	lattice parameter (nm)	2θ (degree)	lattice parameter (nm)
Pd-P@Pt-Ni/C	40.13	0.2244	0.3887	68.67	0.3861
commercial Pt/C	39.72	0.2267	0.3927	67.55	0.3917
Ni powder	44.61	0.2029	0.3514	76.48	0.3519

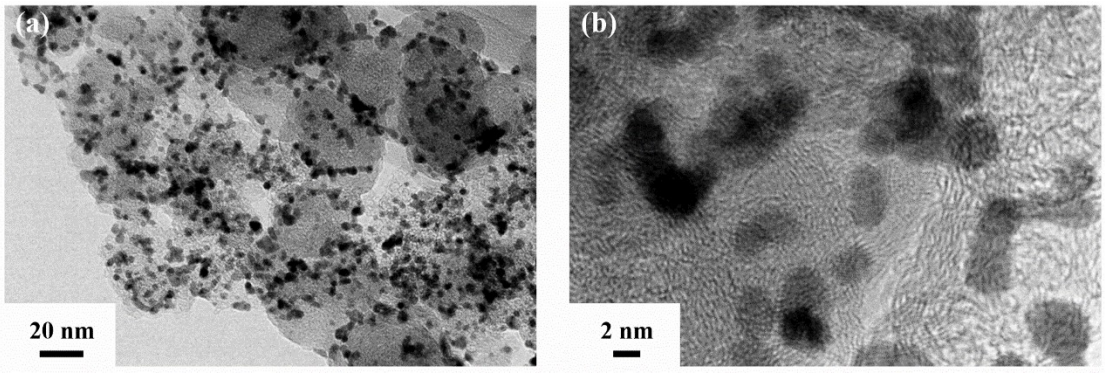

Figure S4. (a) TEM and (b) HRTEM images of the as-prepared Pt/C NPs.

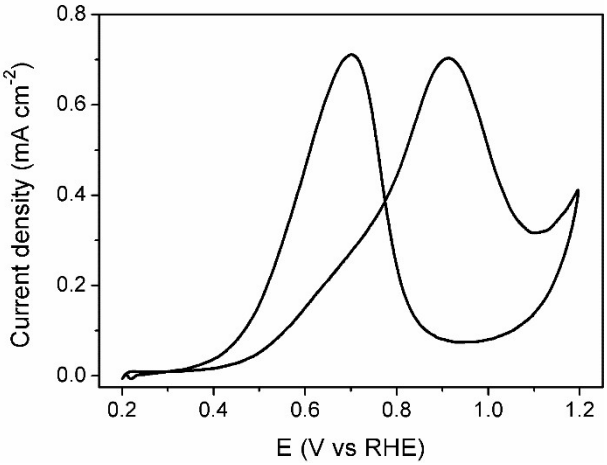

Figure S5. CV curve of Pd-P@Pt-Ni/C NPs in 0.5 M H_2SO_4 + 10 M CH_3OH solution. The sweep rate is 50 mV·s^{-1}.

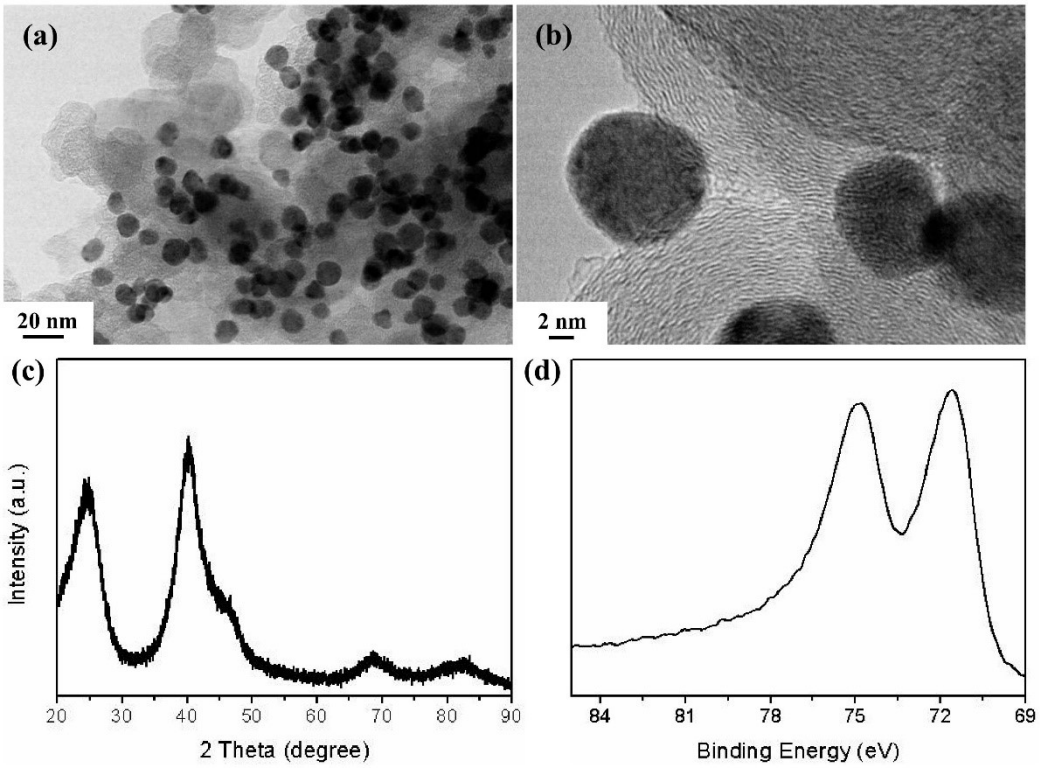

Figure S6. (a)-(b) TEM and HRTEM images, (c) XRD pattern and (d) XPS spectrum of Pt 4f in Pd-P@Pt-Ni/C after the stability test.

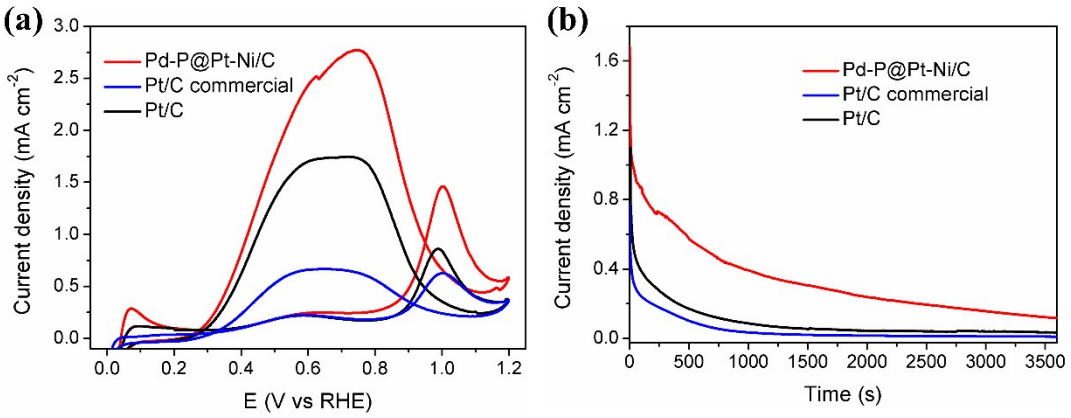

Figure S7. (a) CV curves of Pd-P@Pt-Ni/C NPs, commercial Pt/C and the as-prepared Pt/C in 0.5 M H_2SO_4 + 0.5 M HCOOH solution. The sweep rate is 50 mV·s^{-1}. (b) Chronoamperometry curves of Pd-P@Pt-Ni/C NPs, commercial Pt/C and the as-prepared Pt/C in 0.5 M H_2SO_4 + 0.5 M HCOOH solution at 0.95 V.

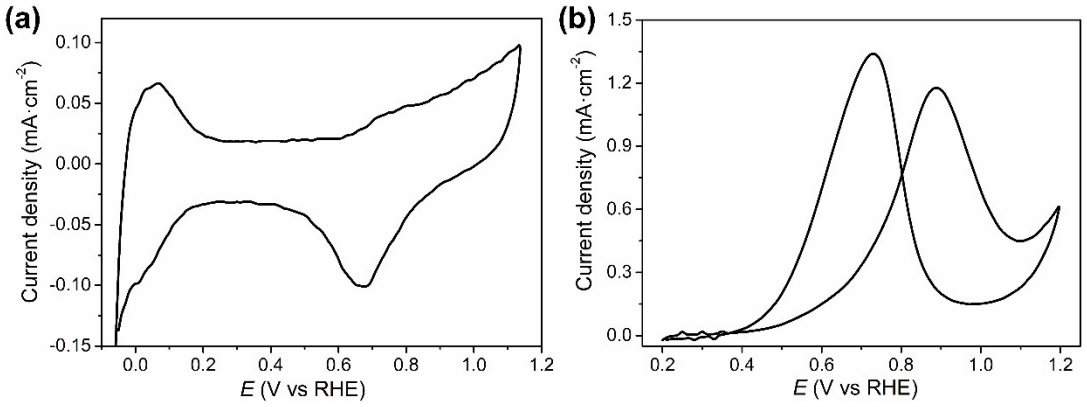

Figure S8. Cyclic voltammetry profiles of Pd-P@Pt/C NPs (a) in N_2-saturated 0.1 M $HClO_4$ solution and (b) in 0.5 M H_2SO_4 + 1 M CH_3OH solution. The sweep rate is 50 mV·s^{-1}.