Electronic Supplementary Information

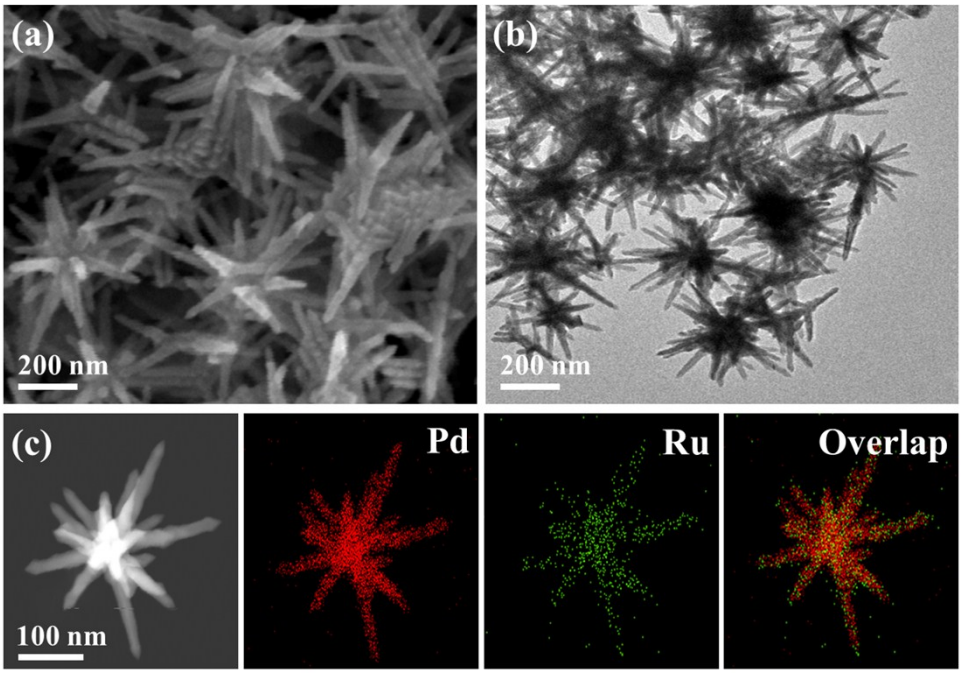

Fig. S1 (a) SEM, (b) TEM and (c) HAADF-STEM and correspongding elemental mapping images of the PdRu NAs.

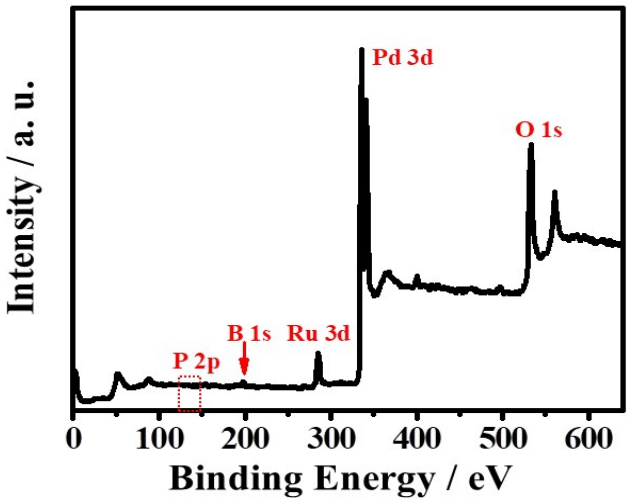

Fig. S2 XPS survey pattern of the PdRuBP NAs.

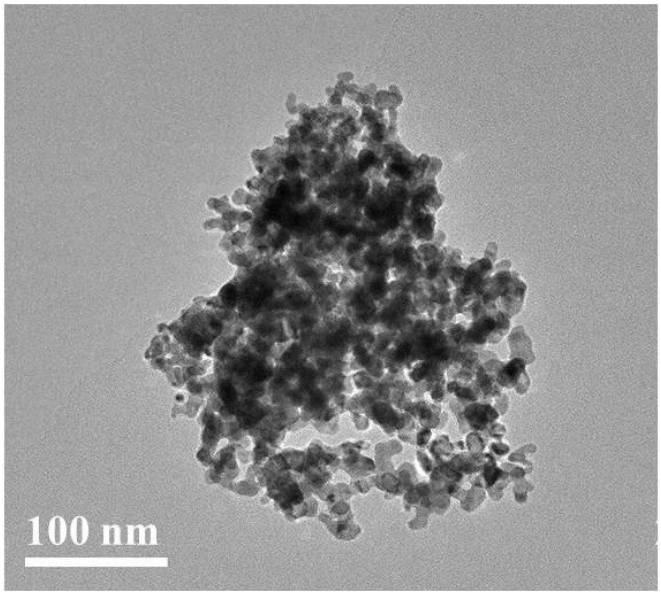

Fig. S3 TEM image of the Pd black.

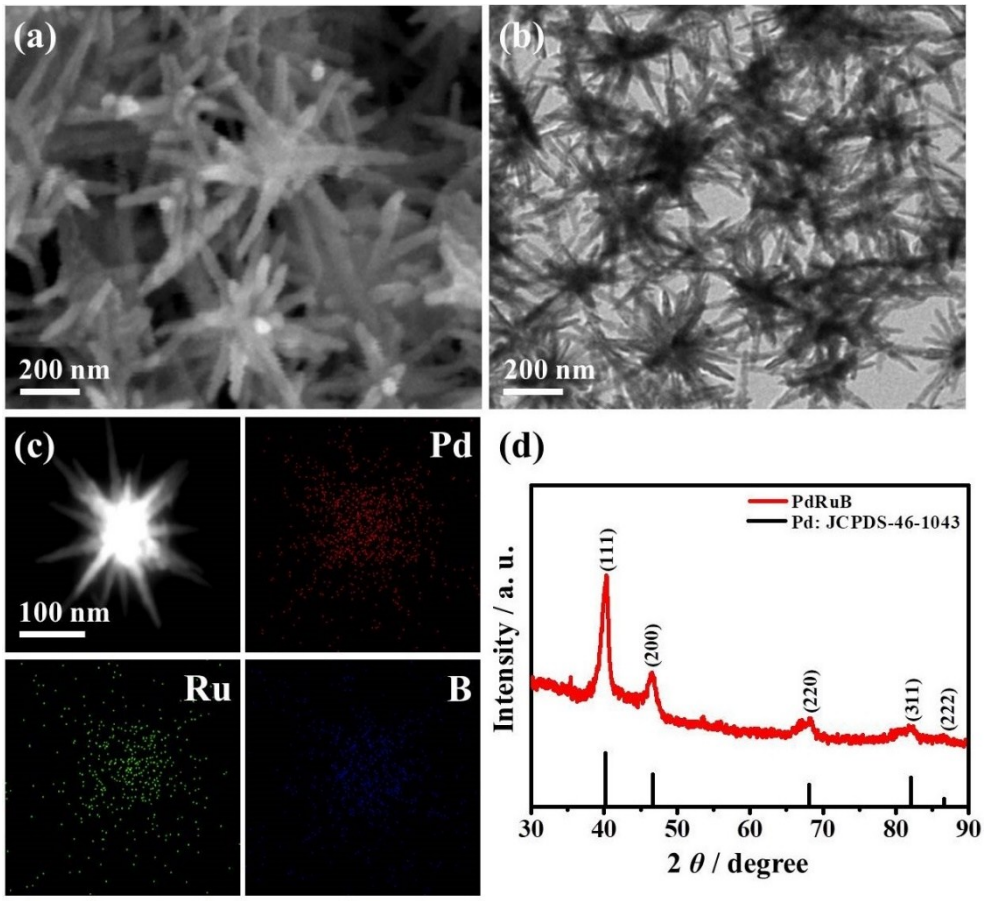

Fig. S4 (a) SEM, (b) TEM, (c) HAADF-STEM and corresponding elemental mapping images and (d) XRD pattern of the PdRuB NAs.

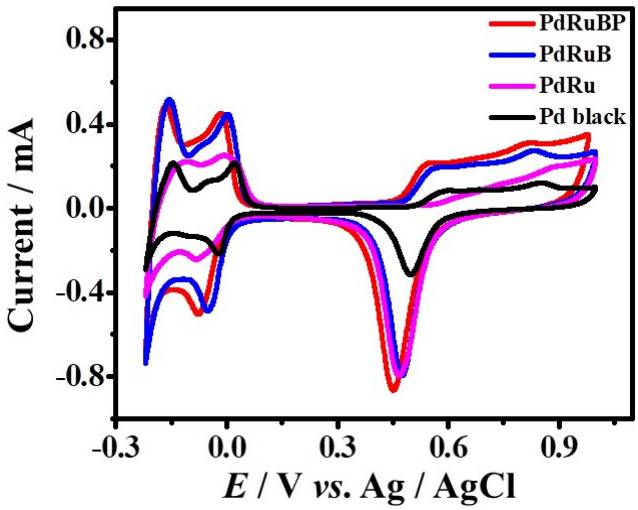

Fig. S5 CV curves of the catalysts in a 0.5 M H_2SO_4 solution with a scan rate of 50 mV s^{-1}.

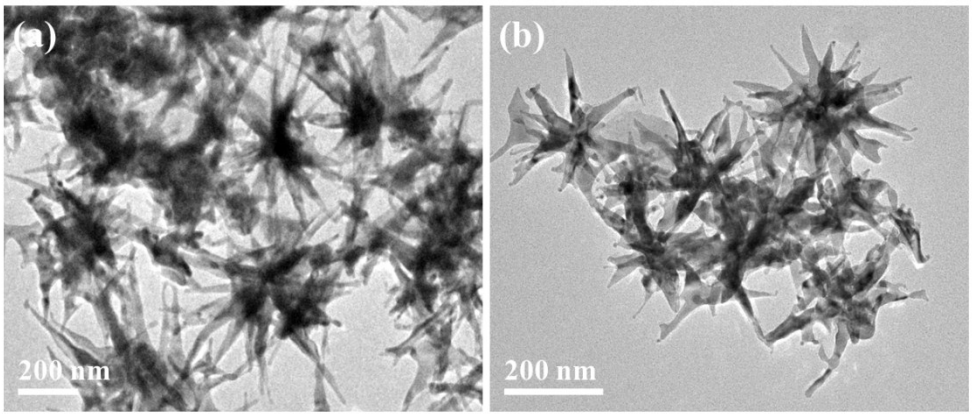

Fig. S6 TEM images of the PdRuBP NAs after electrocatalytic stability testing.

Table S1 The comparisons of FAOR performance for the PdRuBP NAs and some other reported Pd-based electrocatalysts.

Catalysts	Electrolyte	Scan rate ($mV\ s^{-1}$)	Mass activity ($mA\ \mu g_{Pd}^{-1}$)	Ref.
PdRuBP NAs	**0.5 M H_2SO_4 + 0.5 M HCOOH**	**50**	**1.71**	**This work**
PdRu nanospine assemblies	0.5 M H_2SO_4 + 0.5 M HCOOH	50	1.10	[1]
Pd/NP-Coal-CFs(DCD/TPP)	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.537	[2]
CuPd@Pd tetrahedra	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.502	[3]
Twisted PdCu nanochains	0.5 M H_2SO_4 + 0.5 M HCOOH	50	1.108	[4]
Core–shell Pd–P@Pt nanoparticles	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.502	[5]
Pd/PCNTs	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.695	[6]
PdBi nanodot	0.5 M H_2SO_4 + 0.5 M HCOOH	50	1.629	[7]
Pd–Ni_2P/C -30%	0.5 M H_2SO_4 + 0.5 M HCOOH	50	1.425	[8]
Pd-P NNs	0.5 M H_2SO_4 + 0.5 M HCOOH	50	1.505	[9]
Pd-P_{85}/C	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.877	[10]
PdNi/RGO	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.604	[11]
3D super-branched PdCu	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.808	[12]
flower-like Au@AuPd core-shell nanocrystals	0.5 M H_2SO_4 + 0.5 M HCOOH	50	1.250	[13]
$Pd_{51}Cu_{49}$ alloy	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.517	[14]
Cu_3PdN nanoparticles	0.5 M H_2SO_4 + 0.5 M HCOOH	50	0.870	[15]

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