Supplementary Information

Pt Skin on Pd-Co-Zn/C Ternary Nanoparticles with Enhanced Pt Efficiency for the Oxygen Reduction Reaction

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Table S1 XRD results of Pd/C and Pd_xCoZn/C series catalysts

Catalyst	Domain Size(nm)	Lattice parameter (nm)	Strain(%)
Pd/C	15.0	0.3889	-
Pd_4CoZn/C	—	0.3872	0.44
Pd_8CoZn/C	10.3	0.3861	0.72
$Pd_{12}CoZn/C$	11.2	0.3875	0.36

Table S2 electrochemical results of Pd/C and Pd_xCoZn/C series catalysts

Catalyst	$E_{1/2}$ (V)	SA (A m^{-2}_{Pd})		MA (A g^{-1}_{Pd})	
		0.85 V	0.9 V	0.85 V	0.9 V
Pd/C	0.787	0.58	0.067	24.3	0.028
Pd_4CoZn/C	0.819	2.63	0.372	53.4	7.5
Pd_8CoZn/C	0.843	4.75	0.645	140.7	19
$Pd_{12}CoZn/C$	0.83	3.02	0.452	73.6	11

Table S3 The EDS and ICP-AES results of Pd_8CoZn@Pt/C catalyst.

Pd_8CoZn@Pt/C	Weight ratio	Atom ratio
EDS (Pt:Pd:Co:Zn)	4.79:87.48:4.87:2.86	2.42:84.48:8.48:4.62
ICP-AES (Pt:Pd:Co:Zn)	1.91:90.75:5.31:2.5	0.99:86.47: 8.23:4.31

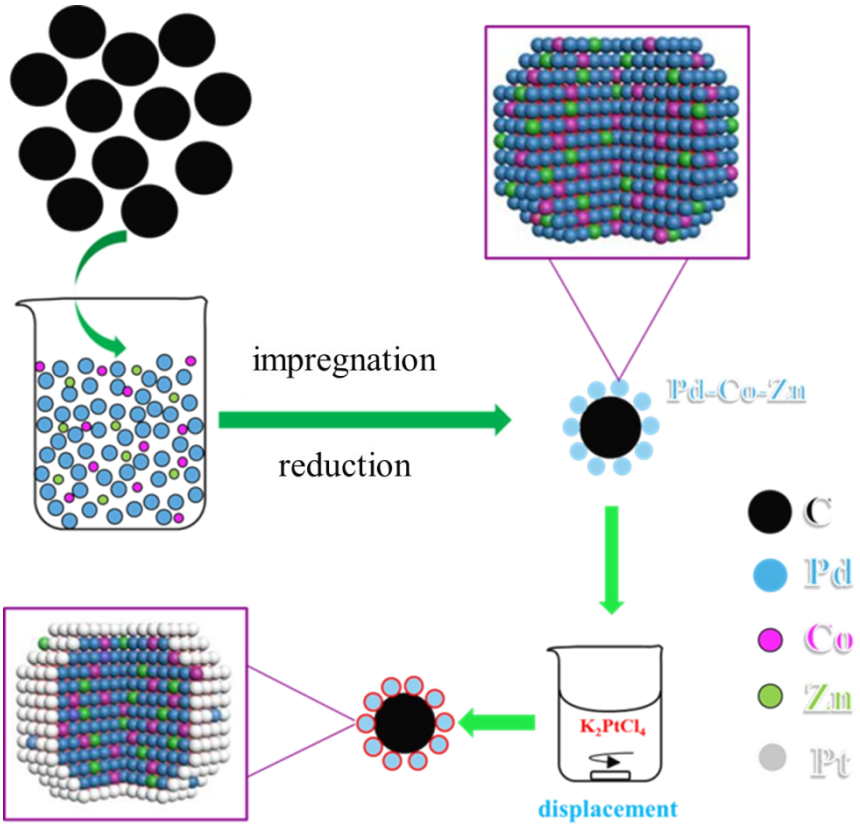

Fig. S1. Illustration of the synthesis procedure for Pd_8CoZn@Pt/C nanoparticles.

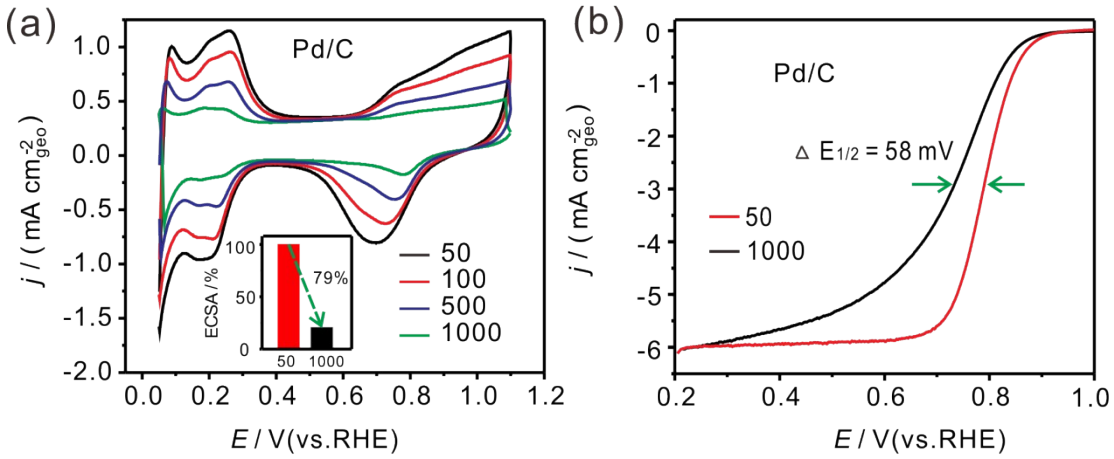

Fig. S2 (a) CVs curves of Pd/C catalyst during cycling between 0.05 V and 1.1 V at a scan rate of 50 mV s^{-1} in N_2-saturated 0.1 M $HClO_4$ solution. The inserts show the changes of corresponding ECSA. (b) ORR polarization curves of Pd/C catalyst in O_2-saturated 0.1 M $HClO_4$ solution at a sweep rate of 5 mV s^{-1} and rotation rate of 1600 rpm before and after 1 K potential cycles.

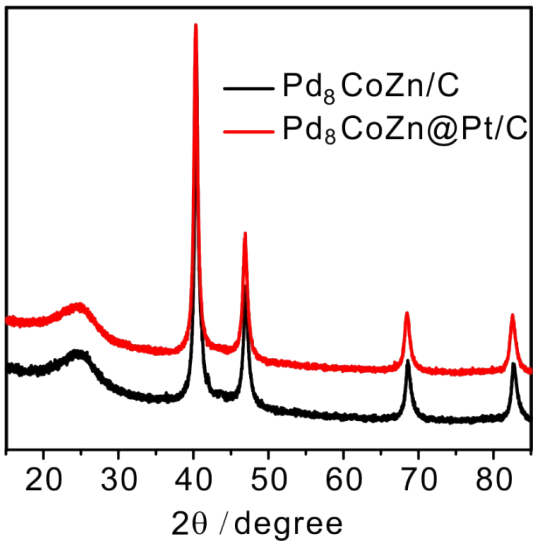

Fig. S3. XRD patterns of Pd_8CoZn/C and $Pd_8CoZn@Pt/C$

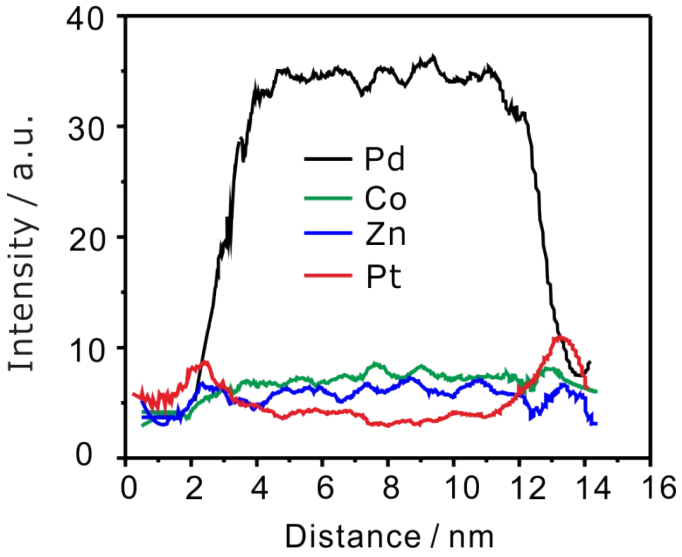

Fig. S4 EDX line profile of Pd (black), Co (green), Zn (blue) and Pt (red).

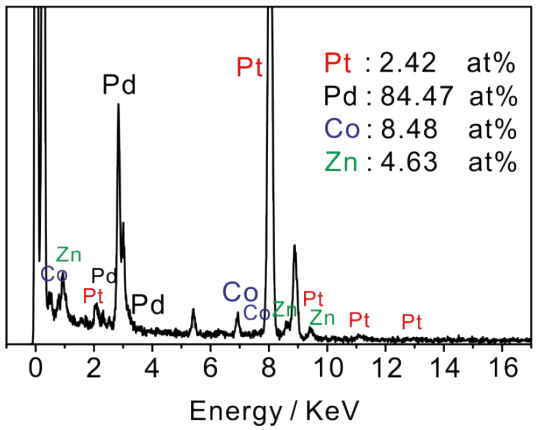

Fig. S5. TEM-EDX of Pd_8CoZn@Pt/C

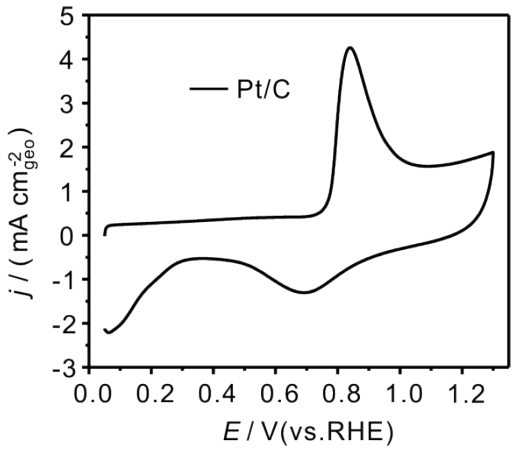

Fig. S6. The CO stripping voltammetry of Pt/C catalyst in N_2-saturated 0.1 M $HClO_4$ solution at a scan rate of 50 mV s^{-1}.

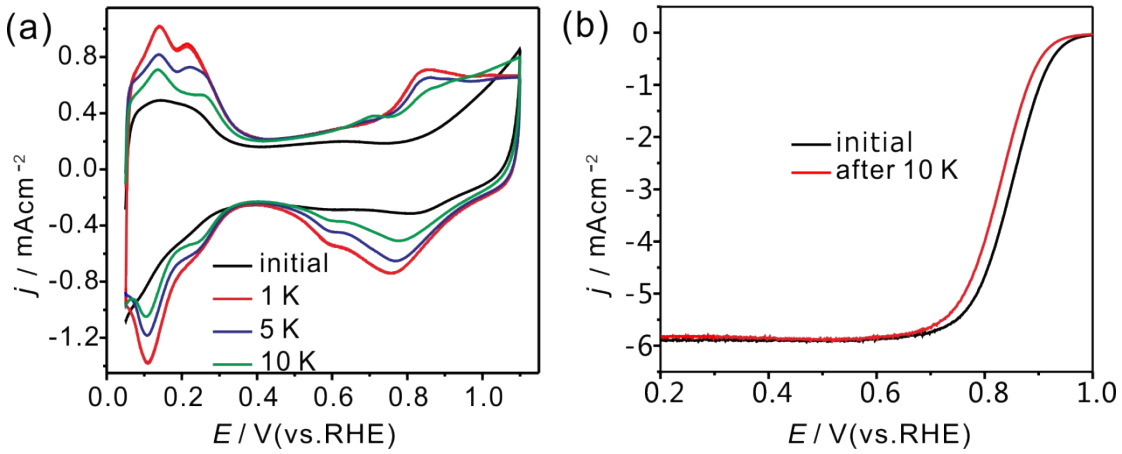

Fig. S7. (a) CV curves of Pt/C after different cycles. (b) The corresponding ORR polarization curves of Pt/C after cycling.