Electronic supplementary information (ESI) for

One-pot production of ceria nanosheets-supported PtNi alloy nanodendrites with high catalytic performance toward methanol oxidation and oxygen reduction

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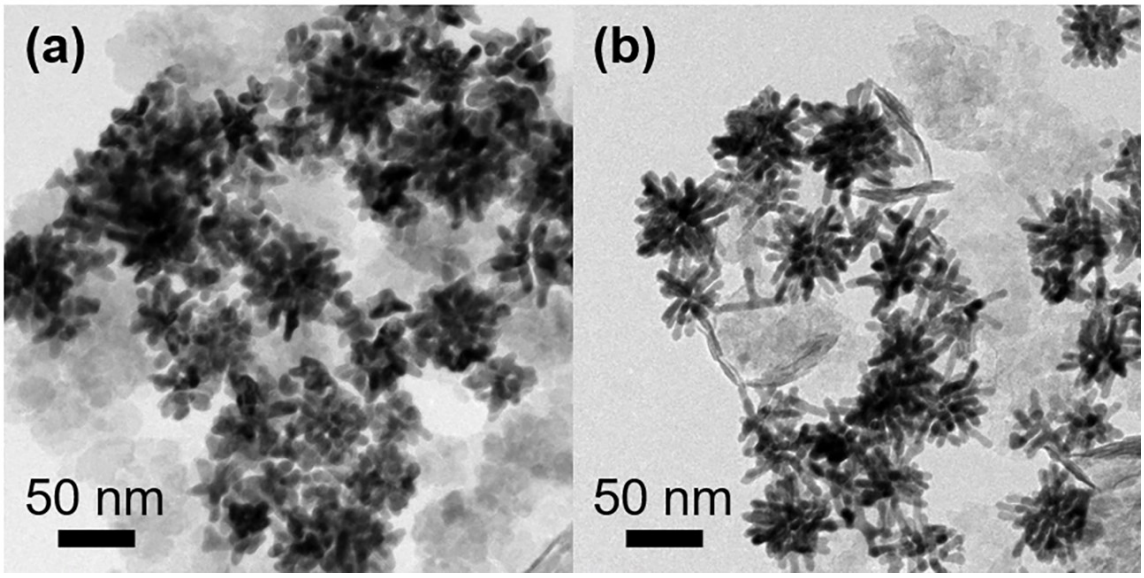

Fig. S1 TEM images of (a) Pt_3Ni/ceria and (b) Pt/ceria. The average sizes of the Pt_3Ni and Pt NDs were 56.5 ± 8.7 and 58.2 ± 6.3 nm, respectively.

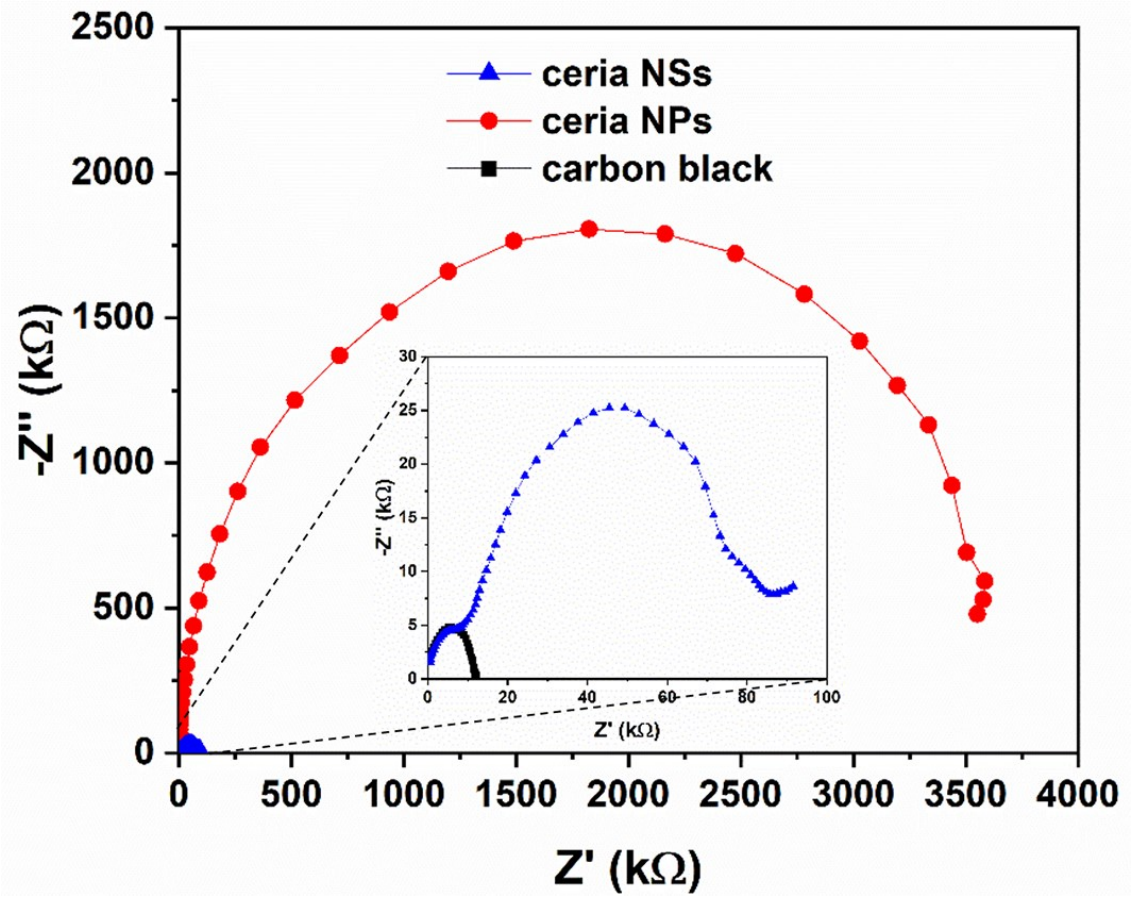

Fig. S2 Nyquist plots of ceria NSs and NPs. For comparison, the Nyquist plot of carbon black is also included.

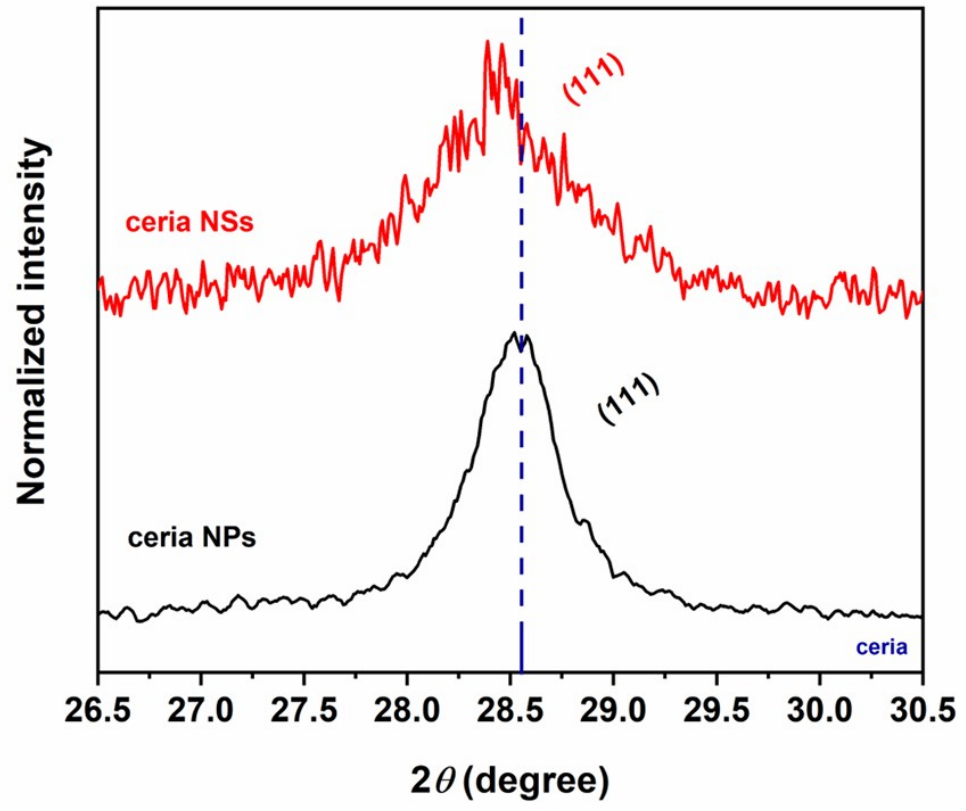

Fig. S3 XRD patterns of ceria NSs and NPs in the (111) diffraction region. The (111) peak positions of ceria NSs and NPs are 28.45^0 and 28.55^0, respectively.

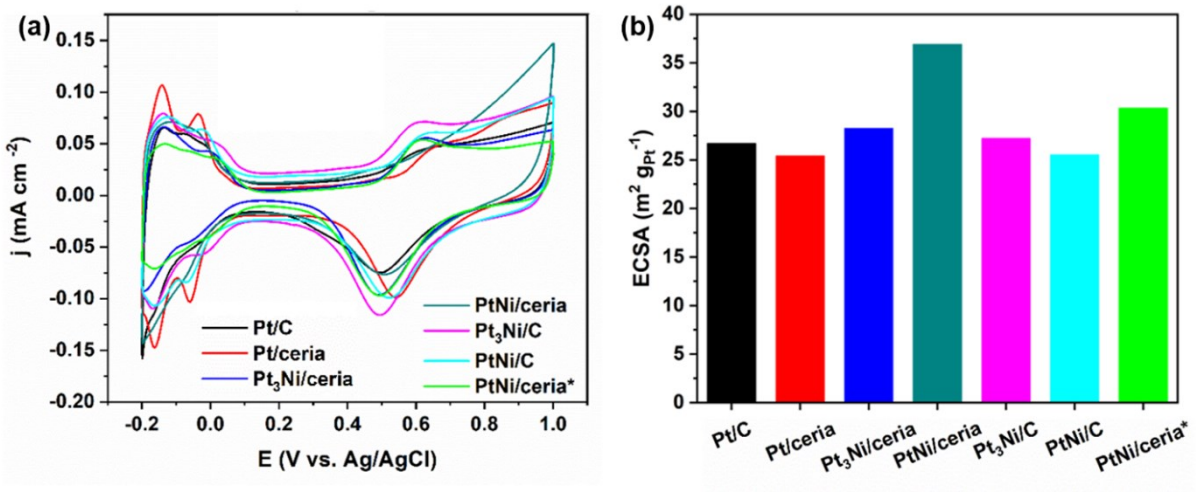

Fig. S4 (a) CVs of various catalysts in 0.1 M $HClO_4$ at a scan rate of 50 mV s^{-1}. (b) ECSAs of various catalysts. The ECSA values of Pt/C, Pt/ceria, Pt_3Ni/ceria, PtNi/ceria, Pt_3Ni/C, PtNi/C, and PtNi/ceria* were 26.7, 25.4, 28.2, 36.9, 27.2, 25.5, and 30.3 m^2 g_{Pt}^{-1}, respectively. ECSA of each catalyst was estimated by the following equation: ECSA = Q_o/q_o, where Q_o is the surface charge that can be obtained from the area under the CV trace of hydrogen desorption and q_o is the charge required for desorption of monolayer of hydrogen on the Pt surface (210 μC cm^{-2}).

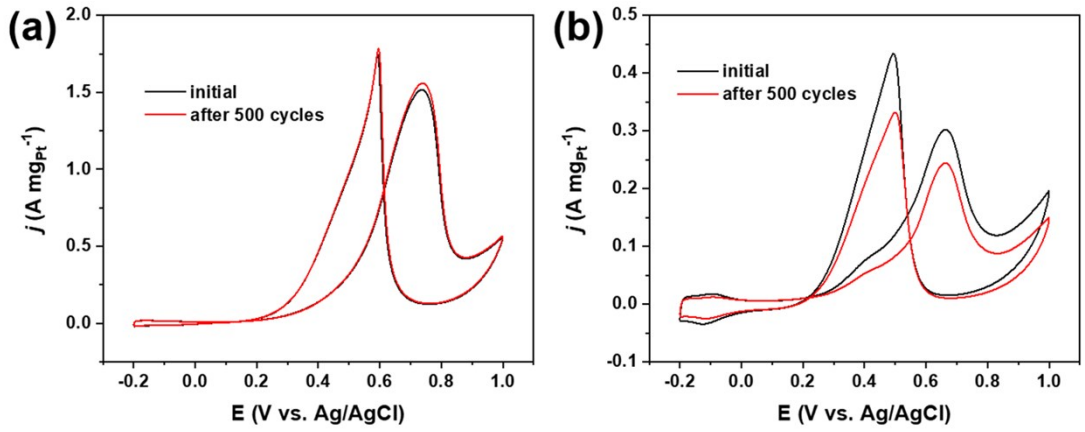

Fig. S5 CVs of (a) PtNi/ceria and (b) Pt/C in 0.1 M $HClO_4$ + 0.5 M methanol at a scan rate 50 mV s^{-1} before and after 500 potential cycles between -0.2 and 1.0 V vs. Ag/AgCl.

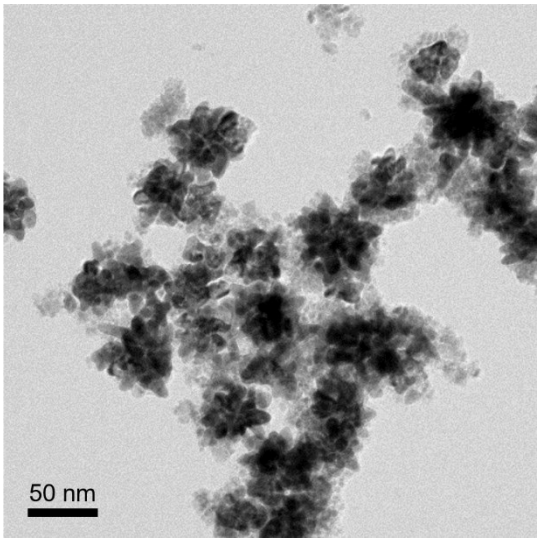

Fig. S6 TEM image of PtNi/ceria after the ADT, demonstrating that the dendrite structure of PtNi/ceria was preserved after the ADT.

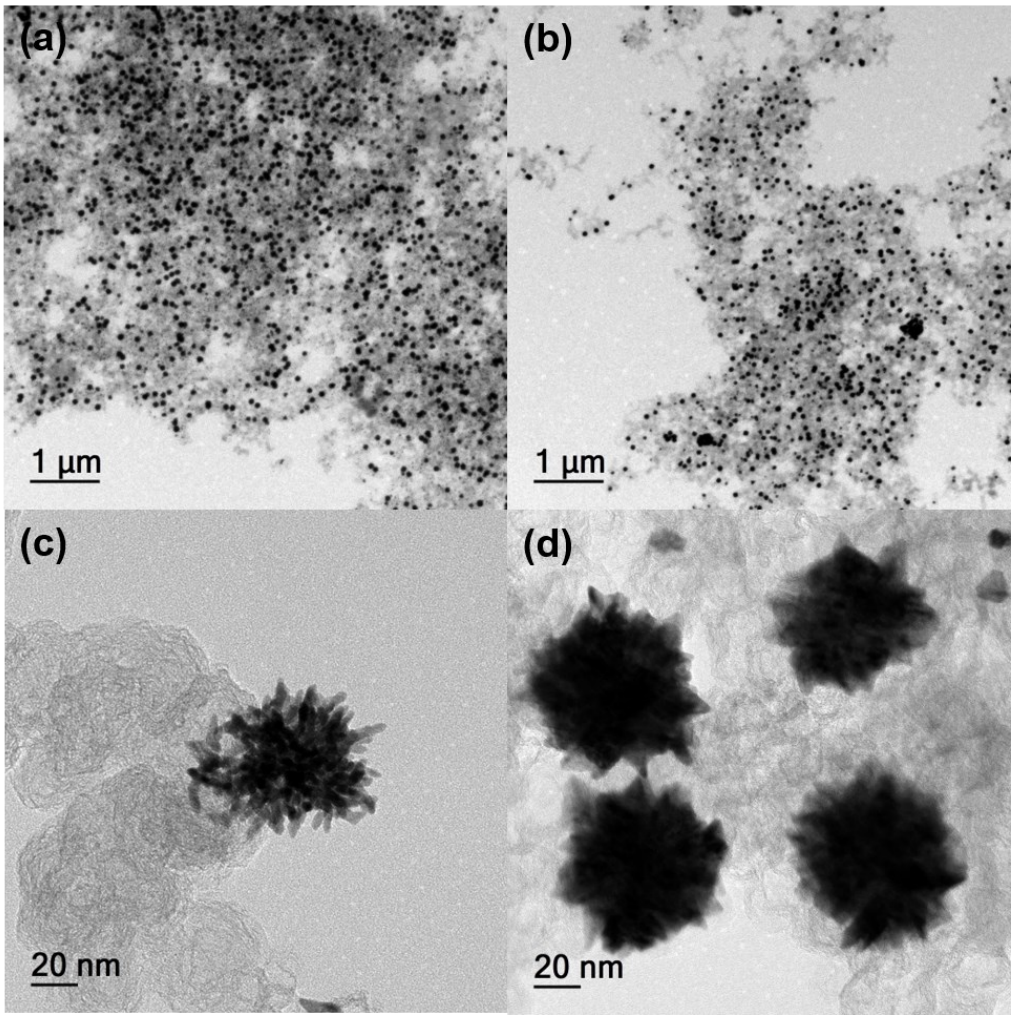

Fig. S7 TEM images of (a,c) Pt_3Ni/C and (b,d) PtNi/C. The average sizes of the Pt_3Ni and PtNi NDs were 57.1 ± 6.3 and 62.9 ± 6.1 nm, respectively.

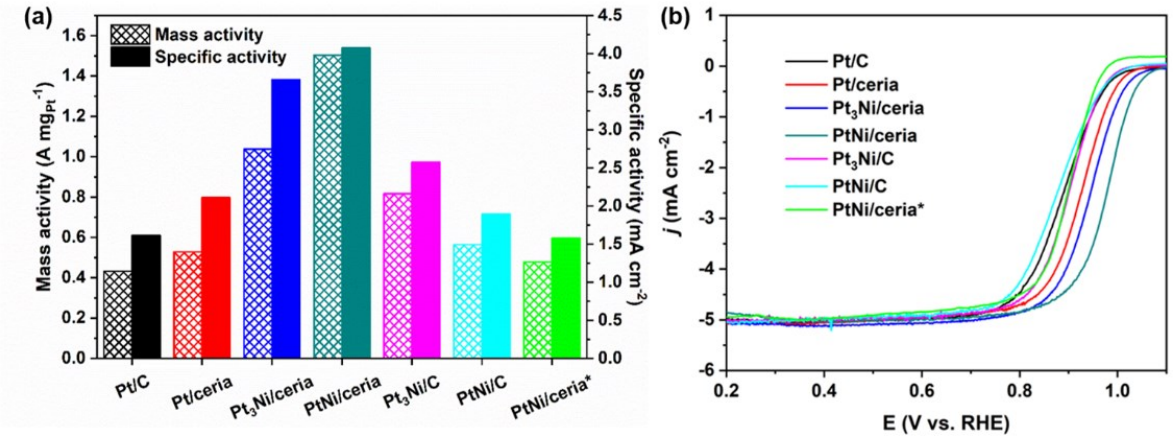

Fig. S8 (a) Mass and specific activities of various catalysts towards MOR. (b) ORR polarization curves of various catalysts. $E_{1/2}$ values of Pt/C, Pt/ceria, Pt_3Ni/ceria, PtNi/ceria, Pt_3Ni/C, PtNi/C, and PtNi/ceria* were 0.889, 0.925, 0.944, 0.978, 0.900, 0.876, and 0.898 V vs. RHE, respectively.

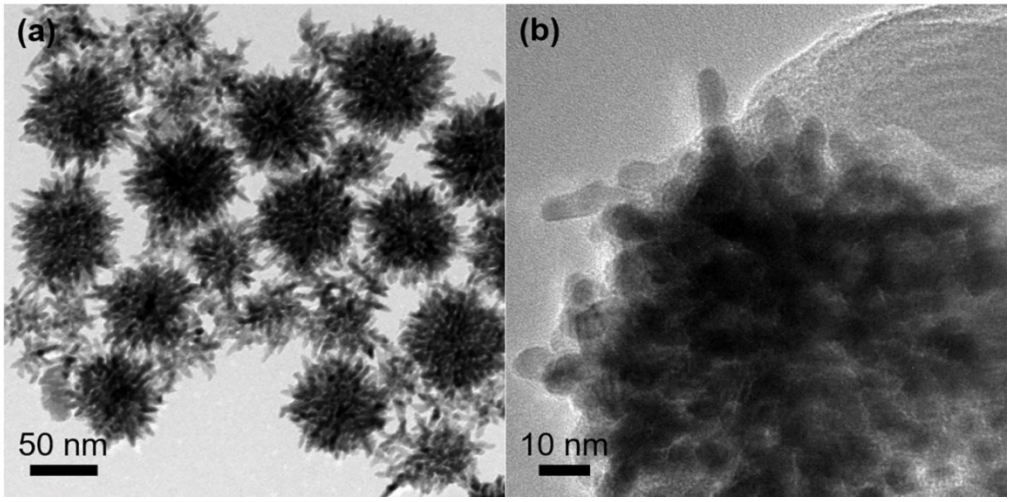

Fig. S9 TEM images of (a) PtNi NDs and (b) PtNi/ceria* prepared by depositing the PtNi NDs on pre-synthesized ceria NSs.