Supporting Information

Solution-plasma interaction for synthesizing highly active Pt-Ni alloy oxygen reduction nanocatalysts for PEMFC

Shuxiu Yang,[a] Yu Tang,[a] Yawen Tan,[a] Bona Fu,[a] Mingyang Liu,[a] Qingzhu Shu,[a] Shuhong Liu[a] and Hong Zhao*[a]

a School of Materials Science and Engineering, Dalian Jiaotong University, Dalian, 116028, Liaoning, China

Synthesis of Catalysts Assisted by Plasma. A 0.1M chloroplatinic acid solution was prepared using hexahydrate chloroplatinic acid ($H_2PtCl_6 \cdot 6H_2O$, 37.5% Pt basis, Aladdin) in deionized water with resistivity greater than 18 MΩ·cm to serve as a reference solution for subsequent experiments. A specific amount of Ketjenblack (ECP 600 JD, Sineero) was weighed and mixed with the 10 mM chloroplatinic acid solution diluted with the reference solution in a beaker, followed by sonication for 5 minutes to obtain a platinum precursor dispersion solution. Activate the magnetic stirrer and peristaltic pump, and once the liquid from the reaction vessel begins to overflow from the top of the quartz capillary, engage the stabilized DC power supply. Then, adjust the voltage to the proper level to create a steady plasma discharge between the electrodes. After a continuous discharge for 30 minutes, the products were filtered and washed with deionized water 2-3 times, then dried in a vacuum oven at 60°C. The dried materials were ground into a powder to obtain the final catalysts of p-Pt/KBs, which were directly used for material characterization and electrochemical measurements without further treatment.

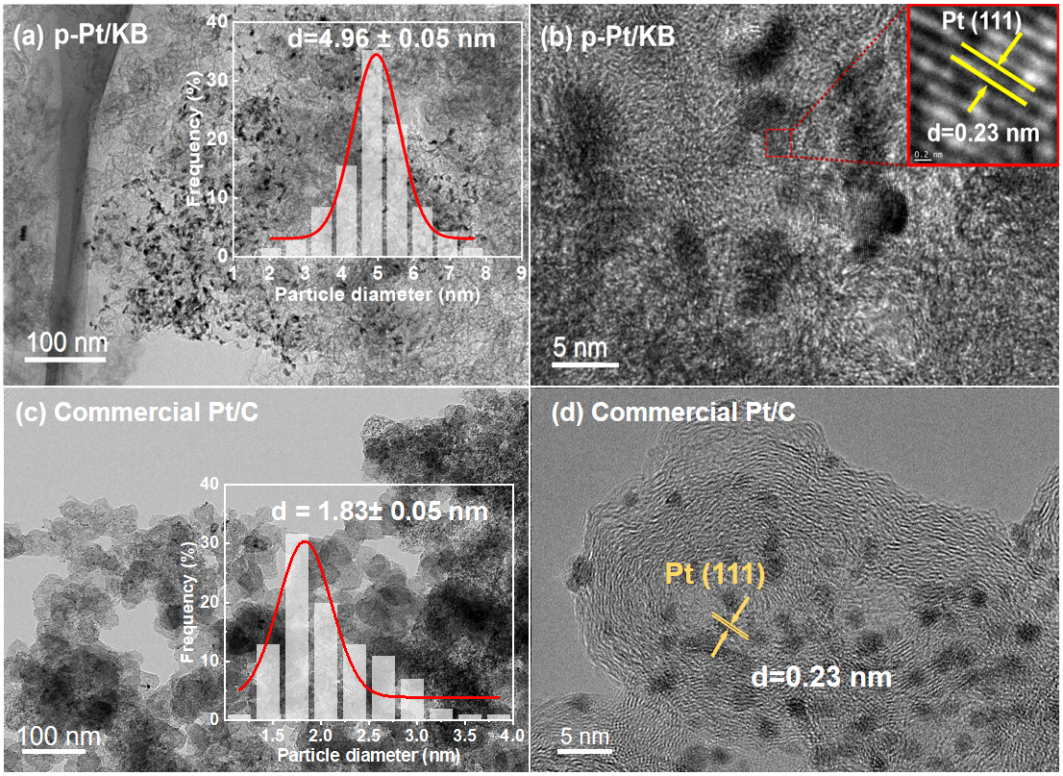

Fig. S1 TEM images and Pt particles size distribution of p-Pt/KB and commercial Pt/C

Table S1 ICP-based component analysis of catalysts with different Pt-Ni molar ratios

Pt-Ni molar ratio	Pt (at %)	Ni (at %)
1:1/2	7.27	3.08
1:1	7.96	6.15
1:2	6.54	10.23

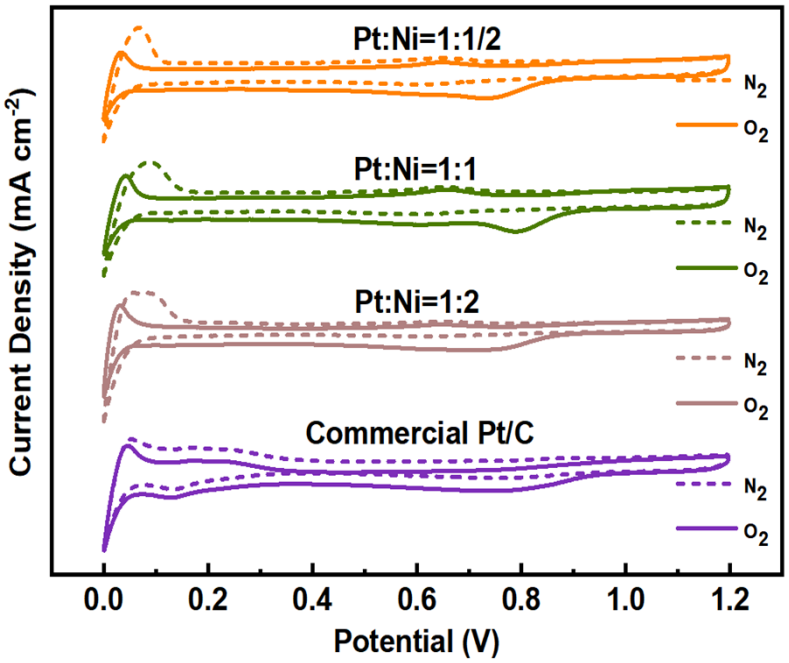

Fig. S2 Comparison of CVs of catalysts with a scan rate of 10 mV s^{-1} .

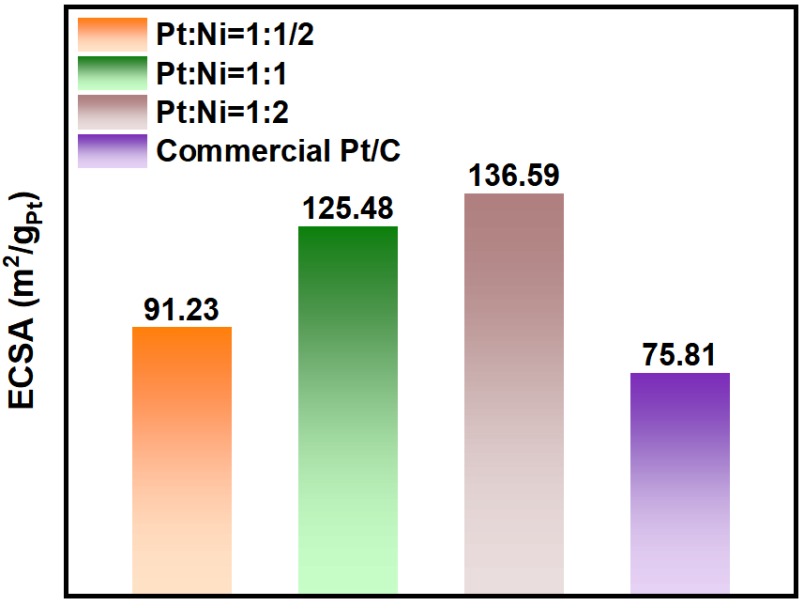

Fig. S3 Comparison of electrochemical surface areas of catalysts with different Pt-Ni molar ratios and commercial Pt/C.

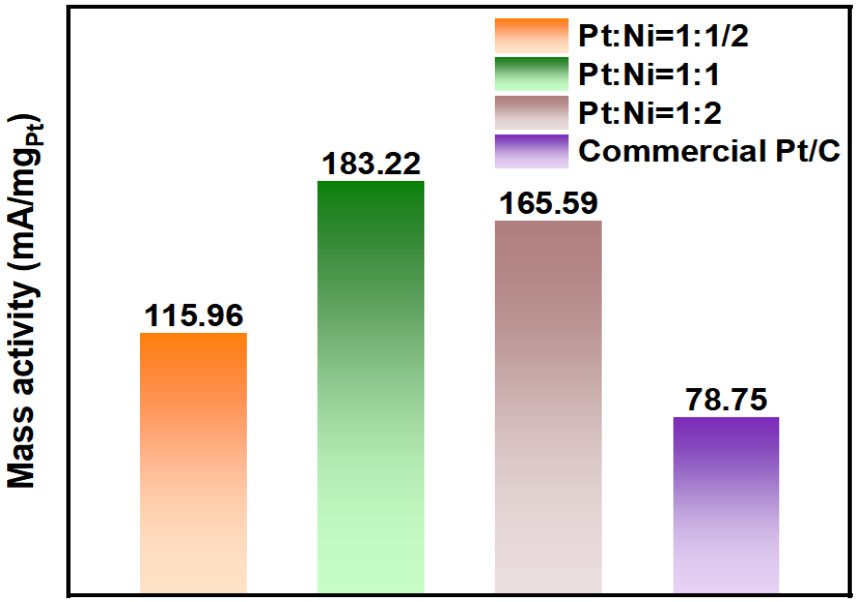

Fig. S4 Comparison of mass activity of catalysts with different Pt-Ni molar ratios and commercial Pt/C.

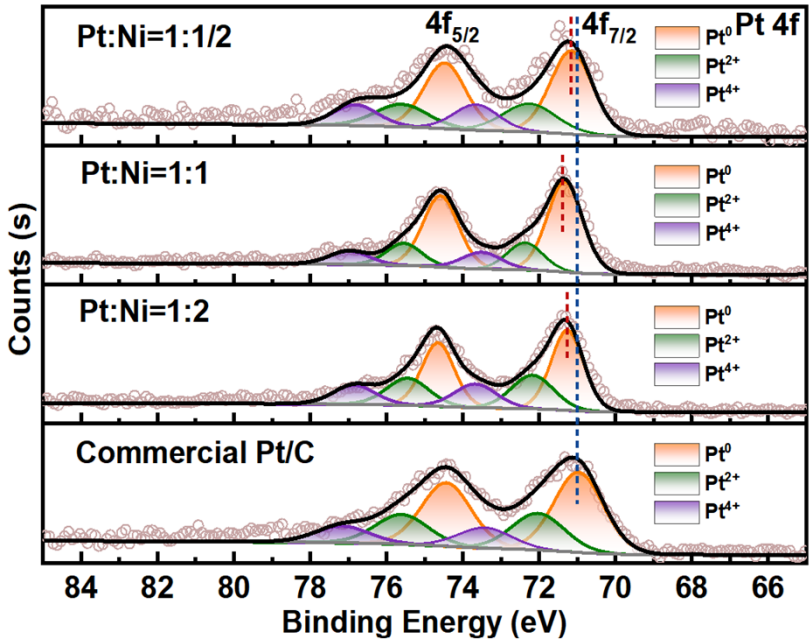

Fig. S5 High-resolution XPS spectra of Pt 4f region for catalysts with different Pt-Ni molar ratios and commercial Pt/C.

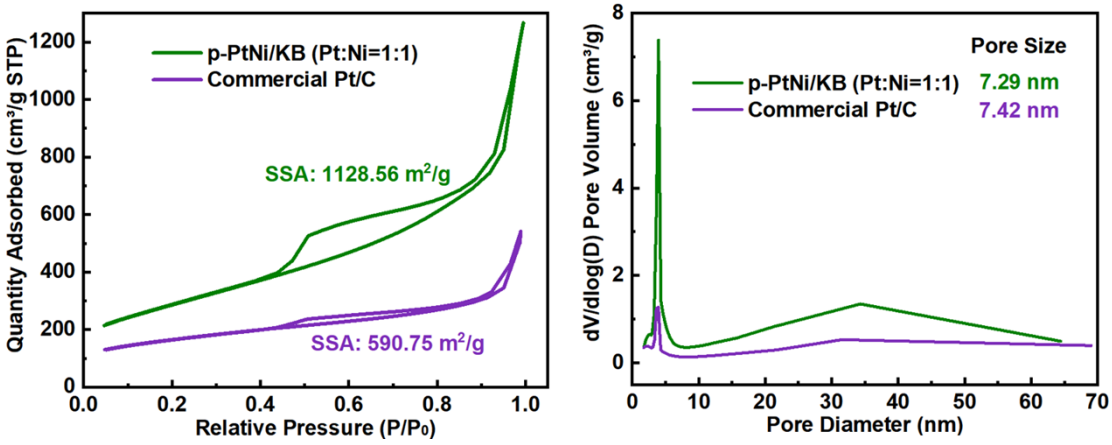

Fig. S6 Nitrogen adsorption-desorption isotherms and pore size distribution of p-PtNi/KB (Pt:Ni=1:1), in comparison with commercial Pt/C.