Silica-Polydopamine Core-Shell Self-Confined Template for Ultra-Stable Hollow Pt Anchored N-Doped Carbon Electrocatalyst

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Chemicals: 3-Hydroxytyramine hydrochloride (DA, 98%) is purchased from Energy Chemical. Nickel nitrate hexahydrate (Ni(NO₃)₂•6H₂O, 98%), chloroplatinic acid hexahydrate (H₂PtCl₆•6H₂O, 98%) are purchased from aladdin[®]. Ethanol (C₂H₅OH, 99.7%), ethylene glycol ((CH₂OH)₂,), ammonia solution (NH₃•H₂O, 25–28%), hydrofluoric acid (HF, 40%), ethyl silicate (C₈H₂₀O₄Si, 28.4%), potassium hydroxide (KOH, 0.1 mol/L), isopropyl alcohol ((CH₃)₂CHOH, 99.7%) and nafion (0.5%) are obtained from Sinopharm Chemical Reagent Co., Ltd. Ultrapure water with a

resistivity of 18.0 M Ω . cm is prepared by Direct-Q[®] 3.

The Koutecky–Levich equations as follows:

$$\frac{1}{J} = \frac{1}{J_k} + \frac{1}{J_L} = \frac{1}{J_k} + \frac{1}{B\omega^{1/2}}$$
(1)

$$B = 0.2n F D_O^{2/3} v^{-1/6} C_O$$
 (2)

where J represents the measured current density, J_{K} and J_{L} mean the kinetic and diffusion limiting current density, respectively, ω stands for the electrode rotation rate, n is the electron transfer number, F represents the Faraday constant (F = 96485C mol⁻¹), D_{0} means the diffusion coefficient for O_{2} in 0.1 M KOH (1.9×10⁻⁵ cm² s⁻¹), v stands for the kinematic viscosity of the electrolyte(1.009 ×10⁻² cm² s⁻¹), C_{0} is a symbol of the bulk concentration of O_{2} dissolved in the electrolyte (1.2×10⁻⁶mol cm⁻³)



Fig.S1 Evolution of reaction process of SiO₂@PDA: (a-f) TEM images at different reaction times. (f) image is same as Fig. 1a



Fig. S2(a) X-ray photoelectron spectroscopy (XPS) survey spectrum of Pt/HN-C and the deconvoluted high resolution XPS spectra of (b)C 1s and (c)O 1s.



Fig.S3 CV curves of (a)Pt/HN-C and (b) commercial Pt/C catalyst in N₂-saturated 0.1 M KOH solution at different potential scan rates. (c) CV curves of commercial Pt/C in N₂- and O₂-saturated 0.1 M KOH at scanning rate of 50 mVs⁻¹.(d) Linear sweep voltammetry(LSV) curves of oxygen reduction on commercial Pt/C catalyst in O₂- saturated 0.1 M KOH solution with different rotating rates from 225 to 1600 rpm. The inset shows the corresponding Koutecky-Levich plots ($J^{-1} vs. \omega^{-1/2}$) at different potentials.



Fig.S4 Current density-potential curves of RRDE modified with Pt/HN-C for ORR in an oxygen-saturated 0.1 M solution of KOH at a scan rate of 20 mV s⁻¹ with a rotation rate at 1600rpm.



Fig.S5TEM image of a single SiO₂@PDA/PtNi.