Promotion of Oxygen Reduction to Hydrogen Peroxide by Ammonium Ions on N-doped Carbon Catalyst

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A lot of efforts have been devoted to the improvement of the catalytic activity and hydrogen peroxide (H₂O₂) selectivity of the catalysts in two-electron oxygen reduction reaction (ORR) utilized for production of H₂O₂. Little attention has been paid to the influence of the electrolyte itself. Herein, we report that the two-electron ORR catalytic performance of the catalyst strongly depends on the cations of the electrolyte. The catalytic performance of an N-doped carbon (PNC) catalyst has been evaluated in two different aqueous electrolytes: (NH₄)₂SO₄ and Na₂SO₄. The results show that the ORR catalytic activity and the H₂O₂ selectivity in (NH₄)₂SO₄ solution are much better than that in Na₂SO₄ solution, namely with H₂O₂ FE of 90.2% and current density of 13.9 mA cm⁻² in (NH₄)₂SO₄ compared to 67.8% and 2.5 mA cm⁻² in Na₂SO₄. The *in-situ* Fourier transform infrared (FTIR) spectroscopy shows that H₂O acts in the reaction in Na₂SO₄ solution as a proton source, but there was no evidence of the same role of H₂O in (NH₄)₂SO₄ solution. Further experimental results also show that the ORR performance of PNC is dependent on the concentration of (NH₄)₂SO₄ solution, but independent on the concentration of Na₂SO₄ solution. Thus, we reasonably infer that ammonium ions have promoted the ORR catalytic performance of PNC.

Keywords: oxygen reduction reaction, hydrogen peroxide, faradaic efficiency, electrocatalysis, ATR-FTIR

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