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New Porous Carbon Electrocatalysts Derived from Ionic Liquid for Oxygen Reduction Reaction

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In the past few years ionic liquids (ILs) have found application in nanomaterials design and synthesis, due to unique physicochemical properties and diversity of cation-anion combination. In the present work, two porous carbon materials were synthesized by two novel methods using IL. 1-butyl-3-methylimidazolium methane sulfonate, with high thermal stability and the melting temperature of 74 °C determined by the HLM method, was used as a medium in ionothermal carbonization of glucose and as a precursor for synthesis sulphur- and nitrogen-double-doped porous carbon in direct carbonization of IL. Carbon materials were characterized by SEM, Raman spectroscopy, N₂ physisorption at 77 K and X-ray photoelectron spectroscopy.

The obtained materials were used as cathodic materials in oxygen reduction reaction (ORR). Electrocatalytical activity of materials was examined by cyclic voltammetry in O₂-saturated 0.1M KOH electrolyte. The material obtained by direct carbonization of IL showed cathodic peak at 0.6 V vs. RHE. Detailed investigation was performed using the linear sweep voltammetry with a rotating disc electrode. Sulphur and nitrogen-doped porous carbon exhibited very good characteristic for application for ORR with direct four electron pathway mechanism. On the contrary, a lower electrocatalytical activity with two-step two-electron pathway was found for the ionothermal carbon.

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