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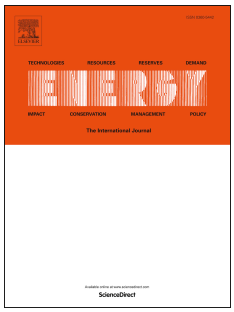

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Nitrogen and cobalt-doped porous Biocarbon Materials Derived from Corn Stover as Efficient Electrocatalysts for Aluminum-air Batteries

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Abstract

Development of convenient, economic and large scale catalysts for oxygen reduction reaction (ORR) in alkaline medium is of great significance to practical applications of aluminum-air batteries. Herein, a corn-stover-derived, nitrogen and cobalt co-doped porous biocarbon material has been prepared and utilized as ORR catalysts in aluminum-air batteries. The resultant product (NCAC-Co) exhibits an interconnected hierarchical porous structure with a high specific surface area (1877.3 $m^2 g^{-1}$). The electrocatalytic characterization of NCAC-Co reveals a half-wave potential (0.743V vs. RHE) only slightly lower than that of commercial Pt/C (0.793 V vs. RHE) in alkaline medium. Moreover, NCAC-Co also demonstrates the mechanism of 4-electron oxygen reduction (n=3.87) and outstanding durability. The excellent ORR performance of NCAC-Co can be attributed to the presence of pyridinic N, graphitic N and Co nanoparticles as well as the interconnected hierarchical porous structure. More importantly, NCAC-Co also delivers a good behavior when applied in aluminum-air batteries. The work presented herein shows the NCAC-Co derived from corn stover holds good promise to be an alternative of economic and large scale catalysts for metal-air batteries.

Keywords: electrocatalyst, oxygen reduction reaction, aluminum-air battery, biomass, porous carbon materials