Transition metal-nitrogen doped porous carbon as efficient oxygen reduction electrocatalysts for anion exchange membrane fuel cells

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Delving for highly active and cost-efficient electrocatalysts for oxygen reduction reaction (ORR) is crucial for the large-scale application of polymer electrolyte fuel cells.[1] Anion exchange membrane fuel cells (AEMFCs) are promising clean energy devices owing to their mild reaction conditions and high probability of utilizing Pt-free catalysts for ORR.[2,3] Hence, Pt-free ORR catalysts for AEMFC are of great importance. In this regard, great efforts have been made to develop efficient Pt-free cathodes for AEMFCs application.[4] This study presents the transition-metal-nitrogen-carbon (M-N-C) electrocatalysts by a robust synthesis approach including the melamine-phloroglucinol-formaldehyde (MPF) polymeric networks embedded with metal. The optimized ORR activity was found by varying the metal content, pyrolysis temperature and different metals (Fe, Co, Mn, and Cu). Amongst, MPF/Fe and MPF/Co catalysts perform better in terms of half-wave potential ($E_{1/2}$) values viz. 0.81 and 0.80 V vs. RHE and are comparable to the commercial Pt/C catalyst attributed to the hierarchical porous structure of the catalysts. Superior electrochemical stability and high-power density in an AEMFC (347 mW cm^{-2}) made the present work direct to develop highly efficient M-N-C catalysts for diverse electrochemical energy conversion applications.[5]

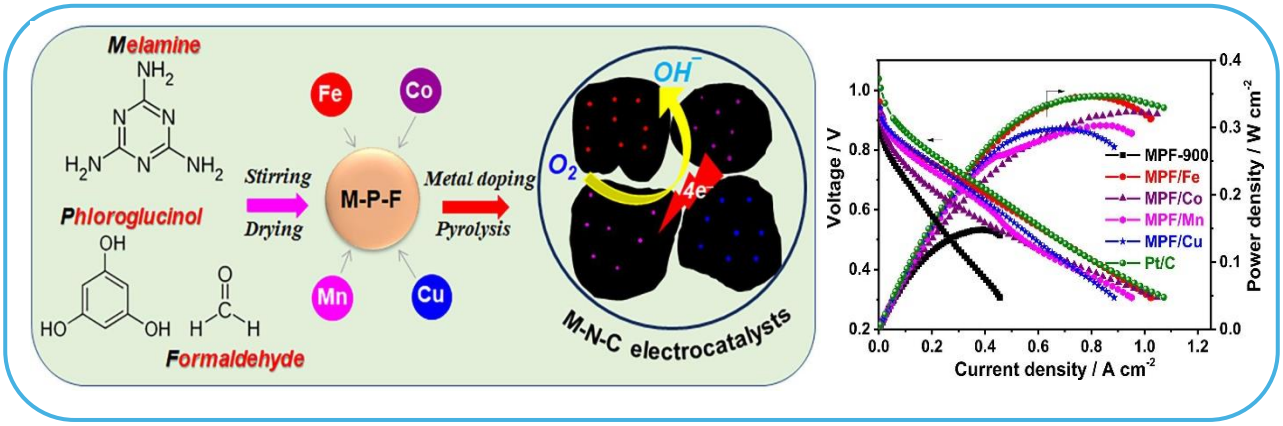

Figure 1. Graphical illustration of the strategy for developing the M-N-C electrocatalysts; H_2-O_2 single-cell AEMFC using MPF/M (M = Fe, Co, Mn, Cu) as cathode (1 mg cm^{-2}) and Pt-Ru/C (0.4 mg$_{Pt\text{-}Ru}$ cm^{-2}) as anode catalyst. T = 65 °C; 200 kPa backpressure; 1.0 NLPM flow rate.[5]

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