Electrochemical Characterization and Oxygen Reduction Kinetics of Cu-incorporated Cobalt Oxide Catalyst

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Electrochemical characterization of Cu incorporated cobalt oxide is carried out and oxygen reduction reaction (ORR) activity also determined at different catalyst loadings (CLs), using thin film rotating disk electrode (RDE) technology. Electrochemical properties such as the electrochemical surface area (ECSA), ORR, mass activity specific activity, as well as the durability of the electrocatalyst is evaluated. ESCA is determined by cyclic voltammetry (CV) measurements in 1 M KOH at 30 °C, using scanning rates of 5–100 mV s⁻¹. The active CO₃⁺ present in the surface of the (CuCoO)_x lattice acts as a donor–acceptor in the reduction sites during the ORR. The oxygen reduction activity for (CuCoO)_x catalysts is evaluated at various rotation rate in the range 400–3000 rpm. The data are analysed using the Koutecky–Levich relationship; parallel lines indicate first-order kinetics. The number of electrons transfer favours a 4e⁻ pathway oxygen reduction process, the rate constant of the reaction is in the range 0.07–0.11 mol L⁻¹ s⁻¹ at CL 0.05 mg cm⁻².

Keywords: (CuCoO)_x, Electrochemical surface area, Oxygen reduction reaction, Koutecky–Levich relationship

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