



Cathode Catalysts on Cobalt Coordination Bis-Diphosphine Complexes



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The structural formula of coordination compounds

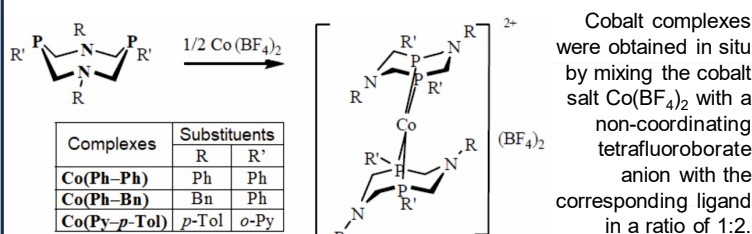


Fig. 1. Brief designations of cobalt complexes with cyclic aminomethylphosphines: Co(Ph-Ph) - $[\text{Co}(\text{P}^{\text{Ph}}_2\text{N}^{\text{Ph}}_2)_2](\text{BF}_4)_2$, Co(Ph-Bn) - $[\text{Co}(\text{P}^{\text{Ph}}_2\text{N}^{\text{Bn}}_2)_2](\text{BF}_4)_2$, Co(Py-p-Tol) - $[\text{Co}(\text{P}^{\text{Py}}_2\text{N}^{\text{p-Tol}}_2)_2](\text{BF}_4)_2$

Morphology of the studied catalysts

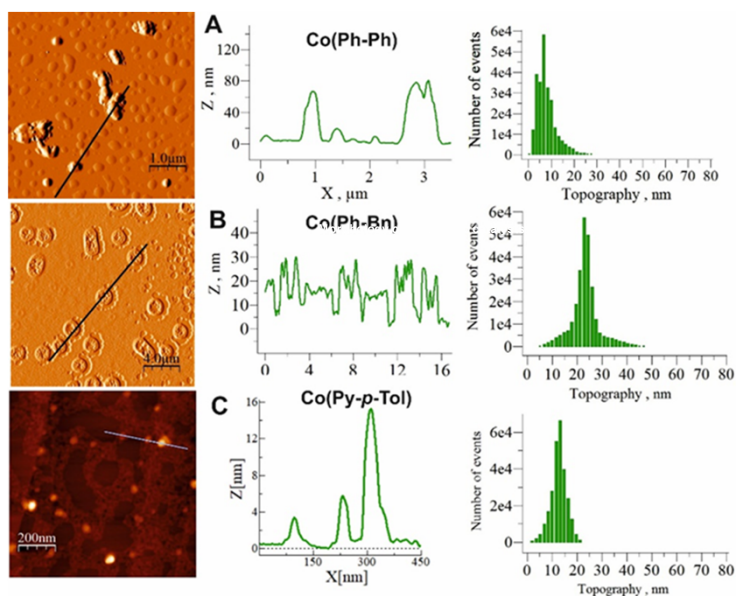
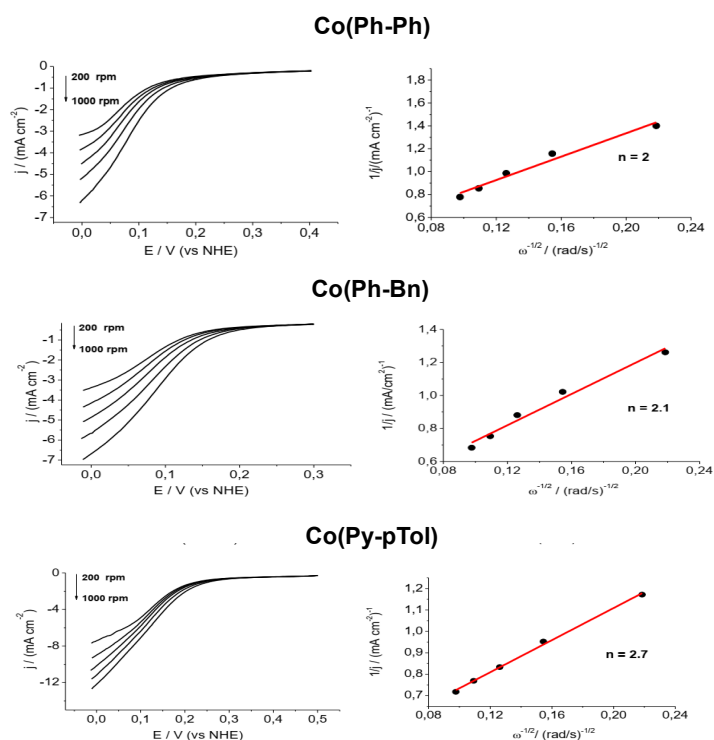


Fig. 2. AFM images of morphologies on the surface of pyrolytic graphite (left), sections along black straight lines (in the center) and particle size distribution histograms (right) of cobalt complexes Co(Ph-Ph) (A), Co(Ph-Bn) (B) and Co(Py-p-Tol) (C)

Objective

Development and study of a new catalyst for the oxygen reduction reaction (ORR) for proton-exchange membrane fuel cells based on cobalt coordination bis-diphosphine complexes.

Oxygen reduction reaction kinetics on a rotating disk electrode



The activity of the catalyst and the number (in brackets) of electrons transferred in one catalytic cycle increases in the series Co(Ph-Ph)/C (2.0 electrons), Co(Ph-Bn)/C (2.1 electrons) and Co(Py-p-Tol)/C (2.7 electrons).

Testing on the fuel cell

Increase the number of electrons transferred in one catalytic cycle also correlates with the increase in the maximum power density observed in the diagnostic characteristics of proton-exchange membrane fuel cell (PEMFC) with cathodes based on Co(Ph-Ph) (5.69 mW), Co(Ph-Bn) (9.01 mW) and Co(Py-p-Tol) (10.17 mW) on carbon black (Vulcan XC-72) and Pt anodes on carbon black (Fig. 3).

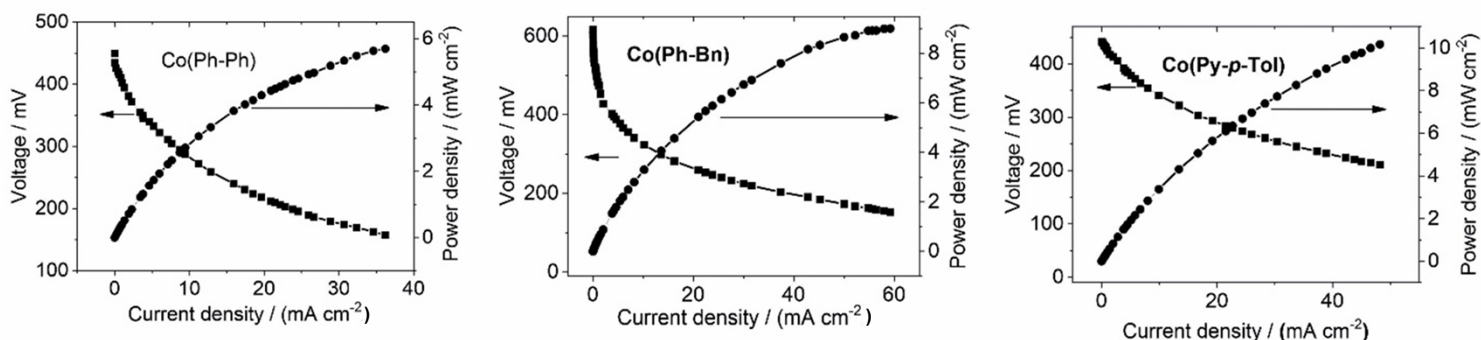


Fig. 3. Diagnostic curves of PEMFC with cathodes based on Co(Ph-Ph) (A), Co(Ph-Bn) (B) and Co(Py-p-Tol) (C) on carbon black (Vulcan XC-72) and anodes on Pt on carbon black