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Fe–Nx active sites in Fe–N–C electrocatalysts synthesized using electron beam irradiation

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Abstract

Fe–N–C catalysts synthesized by the electron beam (e-beam) irradiation pyrolysis of Fe and N precursors is studied owing to their remarkable activities in the electrochemical oxygen reduction reaction (ORR). The conditions for Fe–Nx formation were confirmed by irradiation at 80 kGy under an e-beam energy of 10 MeV and a beam current of 800 μA. The coordination between Fe and each phenanthroline (phen) isomer (1,7-phen, and 1,10-phen) was effectively controlled by molecular structures of monodentate, and bidentate. The pyridinic *N* % was found to be 70.1% for Fe (1,10-phenanthroline)/KB prepared by e-beam irradiation pyrolysis. This catalyst exhibited superior ORR activity and stability in alkaline half-cells. The use of precursors with bidentate coordination is important to obtain the effective inducement of Fe–Nx active sites for electrocatalysts during ORR.

Keywords Fe–N–C · E-beam irradiation synthesis · Oxygen reduction reaction (ORR)