

IRON AND CERIUM ION EXCHANGE ON ZEOLITE AS BIFUNCTIONAL ELECTROCATALYST FOR OER AND ORR IN ALKALINE MEDIA

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Metal-air batteries (MABs) and unitized regenerative fuel cells (URFCs) are one of the most promising electrochemical devices for energy conversion and storage that could support the energy transition from fossil fuels to clean and sustainable energy sources [1]. The oxygen reduction reaction (ORR) and the oxygen evolution reaction (OER) are key reactions for rechargeable MABs and URFCs. Therefore, their performance is highly dependent on the design and activity of the ORR/OER bifunctional electrocatalyst [2].

Zeolites are recognized as promising electrode materials due to their unique structure, large surface area, as well as exceptional ion-exchange capacity and adsorption [2,3]. Herein, the electrocatalytic activity of the material obtained by ion exchange of iron and cerium on zeolite (FeCeZM) was examined towards ORR and OER in alkaline media (**Fig. 1**).

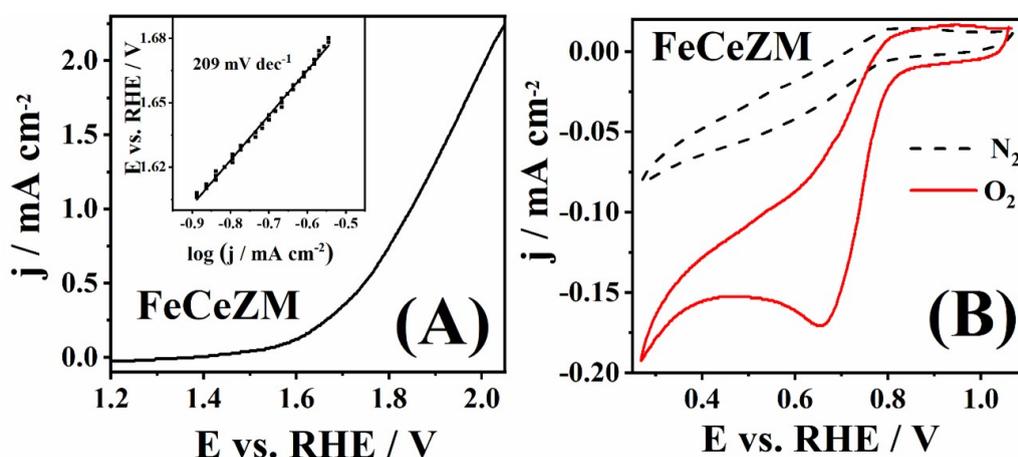


Fig. 1. OER polarization curve (iR- corrected) of FeCeZM with the corresponding Tafel plots in inset (A), and CVs of FeCeZM in N_2 - and O_2 - saturated 1 M KOH (aq) at 5 mV s^{-1} (B).

The OER polarization curve (**Fig. 1A**) shows an onset potential of 1.69 V and Tafel slope of 209 mV dec^{-1} . The aforementioned OER kinetic parameters of FeCeZM are comparable to those reported for other modified zeolite materials in literature [2]. FeCeZM was examined in N_2 - and O_2 - saturated 1 M KOH solution (**Fig. 1B**) by cyclic voltammetry (CV). A characteristic well-defined peak was observed in the O_2 - saturated solution at 0.66 V showing a current density of -0.17 mA cm^{-2} , in contrast to the N_2 -saturated solution in which no peak was observed. This peak corresponds to the reduction of O_2 and indicates that the FeCeZM material is active for the ORR. FeCeZM showed catalytic activity for both OER and ORR, making it a potentially good bifunctional ORR/OER electrocatalyst.

[1] Y. Arafat et al., Adv. Energy Mater. 11, 2100514 (2021)

[2] J. Milikić et al., J. Electroanal. Chem. 944, 117668 (2023)

[3] J. Milikić et al., Synth. Met. 292, 117231 (2023)