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$LiCoO_2$- NiO- $LiFeO_2$ ternary materials for the molten carbonate fuel cell cathode

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Development of alternative cathode materials has been a main strategy for solving the problem of dissolution of the state-of-the-art lithiated NiO cathode in the Molten Carbonate Fuel Cell (MCFC). $LiFeO_2$ and $LiCoO_2$, which were earlier supposed to be the most promising candidates, could not satisfactorily substitute the lithiated NiO. On the other hand, ternary compositions of $LiFeO_2$, $LiCoO_2$ and NiO are expected to combine some desirable properties of each component.

In this work, a strategical approach of finding alternative cathode materials for the MCFC in the $LiFeO_2$-$LiCoO_2$-NiO ternary system has been undertaken. It was carried out by investigating electronic conductivity of the new materials, first in the form of bulk pellets and then in *ex-situ* sintered porous gas diffusion cathodes. Finally, the electrochemical performance of the prepared cathodes were investigated by performing short-time laboratory-scale cell operations.

$LiFeO_2$-$LiCoO_2$-NiO materials in three ternary sub-systems were investigated using powders synthesised by the Pechini method. The electrical conductivity study reveals the ability of improving conductivity, adequate for MCFC cathode application, by controlling the $LiCoO_2$ content in ternary compositions. The existence of $LiFeO_2$-$LiCoO_2$-NiO solid solution and two phase materials phases were detected in the phase analysis performed by X-ray diffraction.

The 20mole%$LiFeO_2$-20mole%$LiCoO_2$-60mole%NiO cathode shows a performance comparable with lithiated NiO cathodes in the cell study. Hence this study reveals the ability of preparing $LiFeO_2$-$LiCoO_2$-NiO cathodes, with considerably less NiO and $LiCoO_2$, for the MCFC application.

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