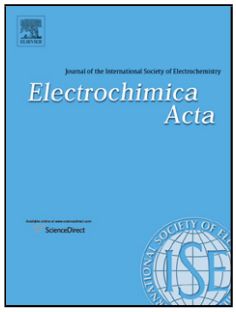

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Diagnosis of a cathode-supported solid oxide electrolysis cell by electrochemical impedance spectroscopy

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Abstract

High-temperature electrolysis (HTSE) is a quite recent topic where most of the studies are focused on performance measurements and degradation observations, mainly achieved by polarization curve. However, it mainly leads to the overall cell behaviour. To get more specific knowledge on the operation of the cell, Electrochemical Impedance Spectroscopy (EIS) is more appropriate. In this study, EIS and chronopotentiometry were combined in order to characterize the electrochemical performance and behaviour of a commercial electrode-supported cell of Ni-YSZ/YSZ/LSCF type. A two-electrode configuration was used while a three-electrode one is required to better separate each component behavior. Nevertheless, it allows applying EIS to any single cell mainly when no good location for a reference electrode is available. Experimental parameters such as current density, temperature or P_{H2O}/P_{H2} ratio were analysed. Using electrical equivalent circuit (EEC) combined to the distribution of relaxation time (DRT) and the analysis of the difference in impedance spectra (ADIS) approaches allowed deconvoluting impedance diagrams into three or four arcs characterized by their specific capacitance and relaxation frequency. Each arc was ascribed to a phenomenon related to the electrochemical reactions. This work corresponds to an *in situ* diagnosis by EIS of solid oxide electrolyser cell reaction mechanisms.