LaFeO3-based mixed conducting anodes for proton conducting solid oxide fuel cells: A study employing model-composite electrodes

Tuesday, 10th July - 17:00 - Foyer - Poster

Mr. Harald Summerer [1], ***Dr. Stefanie Taibl*** [2], ***Mr. Martin Bram*** [3], ***Prof. Jürgen Fleig*** [2], ***Dr. Alexander K. Opitz*** [1]

1. *CD Laboratory for Interfaces in Metal-supported Electrochemical Energy Converters, TU Wien,* ***2.*** *Institute of Chemical Technologies and Analytics, TU Wien,* ***3.*** *CD Laboratory for Interfaces in Metal-supported Electrochemical Energy Converters, Forschungszentrum Jülich, Institute of Energy and Climate Research (IEK-1)*

The ion transport in ceramic electrolytes of solid oxide fuel cells (SOFC) as well as the electrochemical reactions at both electrodes require elevated temperatures. Using high temperature proton conducting ceramics (HTPCs) instead of the more commonly known oxygen ion conductors may provide the possibilty of lowering the operating temperature of 800 - 1000 °C to the range of 400 - 700 °C, which leads to higher thermodynamic efficiency [1]. State of the art HTPC composite anodes have several drawbacks such as agglomeration, which results in electrode degradation over time. To overcome such issues, mixed ionic-electronic conductors (MIEC) are considered as alternatives due to their electrochemically highly active surfaces.

In this study, the electrochemical polarization resistance of the well known perovskite-type MIEC $(La_{0.6}Sr_{0.4})FeO_{3-\delta}$ (LSF) was investigated for both conventional oxide ion conducting yttria stabilised zirconia (YSZ) electrolyte and HTPC electrolytes. Moreover, the effect of doping with basic ions (Ba^{2+}, LSBF) on the electrochemical surface reaction rate and thus the electrode performance was studied. Electrochemical impedance spectroscopy (EIS) measurements on symmetrical cells of thin LSF/LSBF films on the HTPC electrolyte $BaZr_{0.8}Ce_{0.1}Y_{0.1}O_3$ (BZCY81) were carried out in humid reducing atmospheres (2.5 % H_2 / 2.5 % H_2O in Ar) at temperatures between 400 - 700 °C. First results show an increase in surface exchange rates of LSBF electrodes on HTPC electrolytes compared to pure oxygen ion conducting YSZ. This behavior may be explained by an additional proton-based reaction pathway through the mixed conducting LSBF electrode, thus being a first indicator for mixed protonic electronic conductivity in this material.

[1] E. Fabbri, L. Bi, D. Pergolesi, and E. Traversa. Advanced Materials, 24(2):195–208, 2012.