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Sulfur poisoning of Ni/CGO fuel electrodes at low operating temperature

Felix Kullmann (1), Martin Juckel (2) and André Weber (1)
(1) Institute of Applied Materials – Electrochemical Technologies
Karlsruhe Institute of Technology (KIT), D-76131 Karlsruhe/Germany
(2) Institute of Energy and Climate Research – Materials Synthesis and Processing
Forschungszentrum Jülich, D-52428 Jülich/Germany
Tel.: +49-721-608-47765
felix.kullmann@kit.edu

Abstract

A major advantage of the solid oxide fuel cell (SOFC) is the ability to use hydrocarbon fuels such as natural gas, propane or biogas [1]. Usually small amounts of sulfur species are included in these fuels. This leads to poisoning of the fuel electrode and a degradation of the cell performance, which was intensively studied for Ni/YSZ cermet anodes [2-3]. It is well known that the polarization resistance of Ni/CGO fuel electrodes is less [3-4] or even not [5] influenced by sulfur species at 700 to 900 °C operating temperature.
The trend to lower the operating temperature of SOFCs [6,7] even below 600 °C raises the question to what extend the sulfur tolerance of Ni/CGO is maintained at these temperatures. The cell degradation due to sulfur poisoning is less investigated in this temperature regime. In our study we analyze the sulfur poisoning of Ni/CGO fuel electrodes at temperatures below 600 °C. We apply a well-established method, electrochemical impedance spectroscopy (EIS), to determine the sulfur related increase in polarization resistance. By means of distribution of relaxation times (DRT) analysis the impact of sulfur on individual electrochemical processes is detected and subsequently quantified by fitting an appropriate equivalent circuit to the measured data.

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