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SOFC operation with carbon oxides: Experimental analysis of performance and degradation

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Abstract

The high fuel flexibility of solid oxide fuel cells allow them to be operated using carbonaceous fuels. This work focuses on a supply of carbon monoxide on large planar single cells, since detailed investigations thereof are rarely found in literature. In the course of this project, stable cell operation was achieved with $CO/CO_2/N_2$ gas compositions at $800\,°C$ and $750\,°C$ as well as acceptable performance, though test results with $H_2/H_2O/N_2$ gas mixtures were not reached. Electrochemical impedance measurements revealed high polarization resistances to be the cause of this differences in performance. The combination of carbon monoxide and hydrogen as reactants in fuel mixtures results in rapid performance degradation: a performance reduction of 27 % was recognizable within 6 *hours*. Additionally, a 100 *hours* test at $700\,°C$ with $CO/CO_2/N_2 = 20/10/70\ vol\%$ in polarization conditions ($50\ mA\,cm^{-2}$) is also presented, wherein there was continuous degradation at a rate of

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