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Ploner, Alexandra; Hagen, Anke; Hauch, Anne

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Alexandra Ploner, Anke Hagen, Anne Hauch
Technical University of Denmark
Department of Energy Conversion and Storage
Frederiksborgvej 399, DK-4000 Roskilde/Denmark
Tel.: +45-9351-1509
aplo@dtu.dk

Abstract

Solid oxide fuel cell (SOFC) applications require lifetimes of several years on the system level. A big challenge is to proof/confirm/demonstrate such exceptionally long lifetimes. Accelerated or compressed testing are possible methods. Activities in this area have been carried out without arriving at a generally accepted result. First accelerated testing approaches were performed under non-steady operation conditions (current cycling, temperature cycling) by different researchers [1, 2]. However, cycling conditions seemed to have no significant impact on degradation mechanisms. Furthermore, tests done at different current load cycling profiles revealed a strong deviation between predicted and measured lifetime [3].

In this study, we present a detailed analysis of durability results for degradation mechanisms of single SOFC components as function of operating conditions. Electrochemical impedance data is collected and used to de-convolute the individual losses of single SOFC cell components – electrolyte, cathode and anode. The obtained knowledge is adopted to identify operation profiles and appropriate stresses in order to execute appropriate accelerated testing for lifetime investigation of SOFCs.

Fig. 1 Dependency of anode and cathode degradation mechanisms (examples) on operating parameters.