Study of variables for accelerating lifetime testing of SOFCs

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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 singe 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.

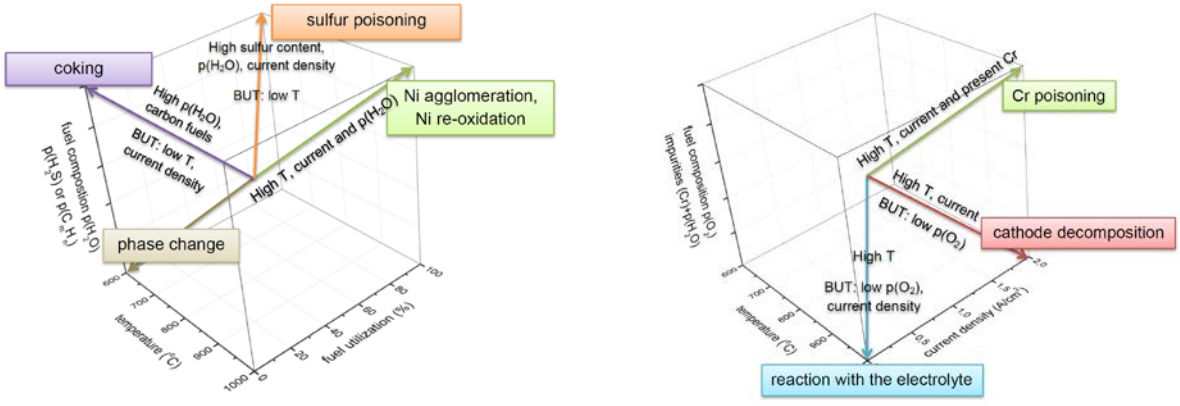

Fig. 1 Dependency of anode and cathode degradation mechanisms (examples) on operating parameters.

[1] M. J. Heneka and E. Ivers-Tiffée J. Fuel Cell Sci. Tech. (9) (2012) 011001
[2] Hagen, J.V.T. Høgh and R. Barfod J. Power Sources, 300 (2015) 223-228
[3] A. Weber, J. Szász, S. Dierickx, C. Endler-Schuck, E. Ivers-Tiffée ECS Trans, 68 (1) (2015) 1953-1960