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ONLINE-MONITORING AS A TOOL FOR STATE-OF-THE-HEALTH PROGNOSTIC AND PREDICTION OF REMAINING USEFUL LIFETIME OF ELECTROCHEMICAL FUEL CELL SYSTEMS

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High-temperature solid oxide fuel cell (SOFC) technology marks a significant step towards emission-free energy and fuel production, thus creating a global sustainable energy system. SOFCs are highly efficient when operating in both part- and full-load modes, due to direct conversion of chemical energy into electrical energy. Compared to low-temperature fuel cells, which require noble metals as catalysts and pure hydrogen as fuel, SOFCs offer great fuel flexibility and use affordable non-precious metallic catalysts. Furthermore, they have a great fuel flexibility and can use not only hydrogen as a fuel, but also various carbon-containing fuels, such as methane, diesel reformat, etc. Fueling SOFCs with conventional or biogenic fuels under certain operating conditions can, however, result in carbon formation on the cell and cause fuel cell degradation, which significantly shortens the cell's lifetime. In order to extend the lifetime of SOFCs and to ensure safe operation for both the stationary and mobile application, a deeper understanding of relevant degradation phenomena must be intensified. For that purpose it should be possible to timely discover the nature of

the ongoing degradation mechanisms by analyzing the available measurement data, predict their trends and suggest counter-measures in order to keep the device within safe margins, extend its life span, and facilitate its maintenance. The methods and principles used to this end will be shown within this study.

Biography

Vanja Subotic is assistant professor and the head of the fuel cell research group at the Institute of Thermal Engineering at Graz University of Technology. She has set his research focus on high temperature processes, including solid oxide fuel and electrolysis cells (SOFC/SOEC), their short- and long-term degradation, their numerical representation via CFD simulations, as well as online monitoring and development of methods for restoring performance of SOFC/SOEC systems. She received her PhD at Graz University of Technology, for which she examined various degradation mechanisms and the possibilities for their detection by applying advanced electrochemical methods, in addition to developing novel strategies for carbon removal and restoring cells' performance in a cell-protecting manner.

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