

Long-term performance degradation study of solid oxide carbon fuel cells integrated with a steam gasifier

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We investigated the long-term performance degradation in a solid oxide carbon fuel cell (SO-CFC) integrated with a steam gasifier that used activated carbon as a fuel. The steam gasifier-integrated SO-CFC was continuously operated for 2000 h at 750 °C under galvanostatic conditions. Fuel analysis, in-situ electrochemical tests, and post-mortem characterization was performed to determine the dominant degradation factors during the extended operation of the SO-CFC. The post-mortem diagnosis via SEM, XRD, EDS, and XPS analyses revealed that the increased Ni particle coarsening and carbon deposition at the anode functional layer induced increased performance degradation in the SO-CFC. The long-term durability study of the SO-CFC with a steam gasifier confirmed that conventional anode materials result in rapid performance degradation during 2000 h continuous operation, and further development of anode materials will be necessary for the long and durable operation of SO-CFCs.