Spectroelectrochemical cell for in situ studies of solid oxide fuel cells

Solid oxide fuel cells (SOFCs) are able to produce electricity and heat from hydrogen- or carbon-containing fuels with high efficiencies and are considered important cornerstones for future sustainable energy systems. Performance, activation and degradation processes are crucial parameters to control before the technology can achieve breakthrough. They have been widely studied, predominately by electrochemical testing with subsequent micro-structural analysis. In order to be able to develop better SOFCs, it is important to understand how the measured electrochemical performance depends on materials and structural properties, preferably at the atomic level. A characterization of these properties under operation is desired. As SOFCs operate at temperatures around 1073 K, this is a challenge. A spectroelectrochemical cell was designed that is able to study SOFCs at operating temperatures and in the presence of relevant gases. Simultaneous spectroscopic and electrochemical evaluation by using X-ray absorption spectroscopy and electrochemical impedance spectroscopy is possible.

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