Improvement of experimental tools for investigating electrodes of solid oxide cells

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Investigating electrochemical processes at single electrodes of solid state electrochemical cells is far from trivial since additional contributions to the cell resistance (ohmic resistances, counter electrode resistance) have to be eliminated before the true working electrode (WE) properties can be analyzed. This presentation summarizes recent developments for improving the experimental designs and sample geometries for both approaches and shows examples to give an overview of new capabilities.

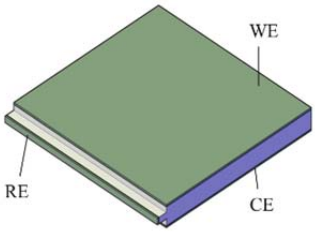

Fig. 1 „Wing Geometry“

i) Three-terminal measurements suffer from several difficulties including the problem of properly positioning the RE. It is discussed that three potential error sources are particularly crucial: Asymmetric sample cells, short circuit currents across the RE, and capacitances between the three electrodes. The **“wing geometry”** is proposed (see Fig. 1) which minimizes the measurement errors significantly.


Fig. 2 Laser heated UHV and ambient pressure XPS stage

ii) Microelectrodes exhibit the advantage that their small size maximizes the polarization resistance and thus mainly the electrode processes at the measured microelectrode are visible in impedance spectra. Still several shortcomings are present. For example, samples with microelectrodes are mostly asymmetrically heated on a heating table in order to enable contacting by a tip from the top. Here, we show by examples that the application field of microelectrodes or microstructured electrodes can be extended by several experimental improvements:


Fig. 3 Sym. heated micro contacts