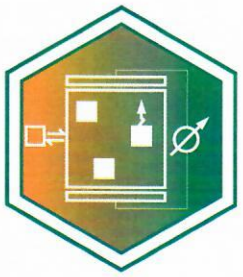
MPI for Solid State Research - Physical Chemistry of Solids



Tuesday May 7, 15:00 in 4D2

Model and parameterisation of positrodes for proton ceramic electrochemical cells

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In order to optimise and stabilise the positive steam-oxygen electrode for proton ceramic electrochemical cells (PCECs) we need proper models for and parameterisation of charge and mass transfer and understand how to extract them from electrochemical impedance spectroscopy (EIS) and voltammetry. The proton-proton charge transfer between the electrolyte and electrode material is accompanied by proton diffusion in and on the mixed conducting electrode material, chemical storage by compositional changes, and redox reactions between protons, oxygen and water vapour on the surfaces. Finely porous electrodes behave like a matrix supporting these processes and are well interpretable along the framework set forth by Adler *et al.*[1] for positrodes for solid-oxide electrochemical cells, involving Gerischer-type mass transfer impedances. Illustrated by results from ongoing studies at UiO I will derive this for PCECs and show how partial oxide ion and p-type electronic conduction in the electrolyte affect the measurements and can be modelled and corrected for. I will also invite to a discussion of the presence and possible origin of an inductive loop (chemical inductance or negative capacitance) in the impedance spectra and show how EIS under DC bias are to be interpreted.

[1] Adler, S.B.; Lane, J.A.; Steele, B.C.H. Electrode Kinetics of Porous Mixed-Conducting Oxygen Electrodes. J. Electrochem. Soc., 1996, 143, 3554. Adler, S.B. Mechanism and kinetics of oxygen reduction on porous $La_{1-x}Sr_xCoO_{3-\delta}$ electrodes. Solid State Ionics, 1998, 111, 125.