

Advanced (Photo-) Electrochemical Impedance Analysis

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Electrochemical Impedance Spectroscopy (EIS) has become an important tool in Solid State Ionics for studying mass and charge transport in electrochemical systems as well as charge transfer and diffusion processes. It is not only of importance for fundamental research, but also for characterizing fuel cells, batteries, sensors, etc.

Oftentimes, the analysis of impedance measurements is hampered by the lack of an adequate model. An empirical analysis by the distribution of relaxation times (DRT) can overcome this problem. This seminar talk will demonstrate the capacity of this analysis method with the help of a number of examples on solid oxide fuel cells (SOFC).

In the field of photoelectrochemistry, photoelectrochemical impedance spectroscopy (PEIS: EIS conducted while illuminating the sample statically) is becoming a method of strong interest. Intensity modulated photocurrent/photovoltage spectroscopy (IMPS/IMVS) are relatively new and powerful techniques but only few results have been published using them. I will also give a brief introduction to the trio of PEIS, IMPS and IMVS and present a comprehensive empirical analysis approach for photoelectrochemical (PEC) cells. It will be demonstrated with measurements on hematite photoanodes that PEIS, IMPS and IMVS are able to provide new insights into the rate-limiting processes in PEC cells and are well-suited to probe the charge carrier dynamics of complex photoelectrochemical reactions.