

Open Access : : ISSN 1847-9286

<https://pub.iapchem.org/ojs/index.php/JESE>

Supplementary material to

Electrochemical behaviour of poly(3,4-ethylenedioxythiophene) modified glassy carbon electrodes after overoxidation – the influence of the substrate on the charge transfer resistance

Dora Zalka, Soma Vesztergom, Mária Ujvári, Gyöző G. Láng

*Institute of Chemistry, Laboratory of Electrochemistry and Electroanalytical Chemistry,
Eötvös Loránd University, Pázmány P. s. 1/A, H-1117 Budapest, Hungary*

J. Electrochem. Sci. Eng. **8(2)** (2018) 151-162

The four-dimensional analysis method is based on the assumption for the continuum of the object's state and parameters space. It requires several impedance spectra recorded subsequently at the same set of frequencies (Fig. S1a). Every measured data at a given frequency should additionally contain the time of measurement (these so-called "timestamps" can be the starting or ending times of the measurements of the individual impedance values, arithmetic or other suitably selected averages, etc.).

Thus, the experimental data form a set of 4-dimensional arrays, containing frequency, real and imaginary reconstruction of calculated instantaneous impedances. For every measured frequency two one dimensional functions of "iso-frequency dependencies" (e.g. for the real and for the imaginary components, Figs S1b and S1c) are constructed. On the basis of the continuity of the evolution, interpolation is performed (e.g. by using interpolating or smoothing cubic spline or other interpolation techniques) resulting in instantaneous projections of the full impedance-time space and "reconstructed" instantaneous impedances related to a selected instant of the time (i.e. the beginning of each frequency scan, Fig S1d). By extrapolation of the iso-frequency dependencies to an instant outside the time interval of the impedance measurements the impedance diagram corresponding to the assumed starting time of the measurement series can be constructed.

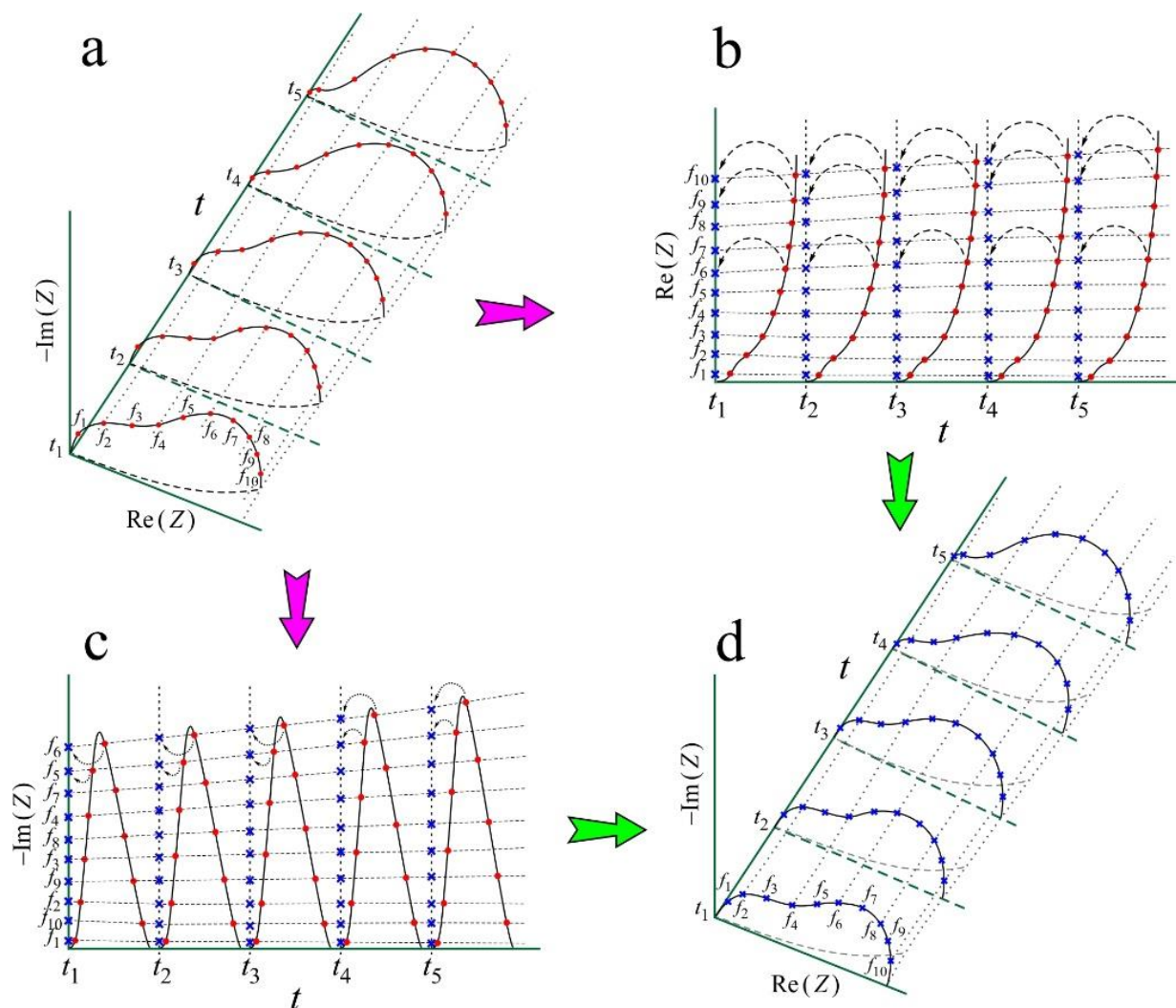


Figure S1. Scheme of the four-dimensional analysis method. 3-D representation of the impedance and time evolution in the coordinates $Re(Z)$, $-Im(Z)$ and t (a), where $Re(Z)$ and $Im(Z)$ are the real and imaginary parts of the complex impedance, respectively, t is the time. •: data points (impedances) measured at frequencies f_i ; t_j : starting time of the j -th frequency scan. b) Calculation of the instantaneous (corrected) $Re(Z)$ values (x) by interpolation of the measured $Re(Z)$ data. c) Calculation of the instantaneous (corrected) $-Im(Z)$ values (x) by interpolation of the measured $Im(Z)$ data. d) 3-D representation of the “reconstructed” instantaneous impedances related to the beginning of each frequency scan. x: corrected data points (impedances) assigned to frequencies f_i .