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FAST FOURIER TRANSFORM ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY FOR MONITORING SURFACE MODIFICATION

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The most recent advances in the development of electrochemistry enabled the development of fast Fourier transform electrochemical impedance spectroscopy (FFT-EIS) [1, 2]. FFT-EIS is one of the fastest and the most informative electrochemical techniques, which in very short period of time can provide EIS spectra. Therefore, FFT-EIS is very useful for the investigation of very dynamic electrochemical systems and for monitoring in real time formation of various layers on different surfaces [3-6].

FFT impedance spectrometer was constructed by professor Georgi Popkirov who developed and advanced FFT EIS based technique together with prof. R. N. Schindler in 1990 [1, 2]. In this technique, system is perturbed not by the consequently applied sine waves of different frequencies, but by the superposition of 30-50 sine waves with properly chosen frequencies. If frequency range from 1.5 Hz to 50 kHz is applied, then the measurement time is just 0.67 s. It is a big advantage of this technique to acquire EIS spectra many times faster in comparison with conventional EIS based techniques.

A significant advantage of FFT-EIS spectrometer is that it is easily controlled. All "bad" data points can be controlled/avoided. All information we need is presented on the screen and everyone who measures impedance spectra can see "good" or "bad" measurement is performed. If we see a lot of red lines on the screen, we should improve quality of the measurement (remove bubbles on the electrode, check reference electrode, wires parasitic capacitances and other). EIS data then are calculated into real and imaginary parts of impedance and presented in Nyquist plot. Also, there is possibility to plot data in Bode coordinates, and even to calculate EIS parameters by fitting data using simple Randles' circuits.

The biggest advantage of FFT-EIS equipment is fast measurement and data validation by easily controlling and avoiding bad data points.

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