

Hyphenated in situ conductance and spectroelectrochemical studies of polyaniline films in strongly acidic solutions

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Abstract

The redox transformations of polyaniline (PANI) have been studied in acidic solutions of $\text{pH} < 1$ by in situ optical electrochemistry and in situ ac conductance technique applied both separately and by using them in a hyphenated mode. For the combination of the two in situ electrochemical techniques, thin layers have been deposited on a special double-band ITO electrode (dbITO), with a gap of $15 \mu\text{m}$. The structure of the dbITO printed circuit electrode made possible to monitor simultaneously the electrochemical, the optical and the conductance changes during the redox processes, occurring in the self-same film. Spectral features confirmed the existence of protonated segments in the reduced film, formed in these strongly acidic media, assumingly via the proton partition at the reduced film/solution interface, coupled also with anion uptake to fulfil electroneutrality. The simultaneous in situ spectral and ac conductance data gave evidence that the development of the conducting state starts only with the oxidative transformation of emeraldine type radical cations coupled with anion entry, leading to the increase in the quinoid/benzonoid ratio in the charge carriers.

Keywords: Polyaniline; Redox transformation; In situ spectroelectrochemistry; In situ conductance