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Numerical Resolving of Net Faradaic Current in Fast-Scan Cyclic Voltammetry Considering Induced Charging Currents

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Abstract : In this work, the theoretical and experimental effects of induced charging currents on fast-scan cyclic voltammetry (FSCV) are investigated. Induced charging currents arise from the effect of ohmic drop in electrochemical systems, which depends on the presence of an uncompensated resistance. They cause the capacitive contribution to the total current to be different from the capacitive current measured in the absence of electroactive species. The paper shows that the induced charging current is relevant when the capacitive current magnitude is close to the total current, even for systems with low time constant. In these situations, the conventional background subtraction method may be inaccurate. A method is developed that separates the faradaic and capacitive currents by using a combination of voltametric experimental data and finite element simulation, by the obtention of a potential-dependent capacitance. The method was tested in a standard electrochemical cell with Platinum ultramicroelectrodes, in different experimental conditions as well in previously reported data in literature. The proposed method allows the real capacitive current to be separated even in situations where the conventional background subtraction method is clearly inappropriate.

Keywords : capacitive current, fast-scan cyclic voltammetry, finite-element method, electroanalysis
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