Dual dynamic voltammetry for the investigation of ferrate ion production

Ábel Zsubrits[1], Gyözö G. Láng[2]
[1] *Eötvös Loránd University, Hevesy György PhD School of Chemistry, Pázmány Péter sétány 1/A, H-1117 Budapest, Hungary,*
[2] *Eötvös Loránd University, Institute of Chemistry, Laboratory of Electrochemistry and Electroanalytical Chemistry, Pázmány Péter sétány 1/A, H-1117 Budapest, Hungary*
zsubritsabel.98@gmail.com

Ferrate ions can be produced electrochemically with the transpassive dissolution of iron containing anodes. During this process, the parasitic oxygen evolution is inevitable. The oxygen evolution decreases the current efficiency of ferrate production and makes the characterisation of the ferrate ion formation process difficult. Usually, the electrochemical ferrate production is characterized by the accumulated ferrate ion concentration. Since ferrate ions are highly unstable and their decomposition rate depends on many circumstances (including cell design) that are difficult to control, most characterization for electrochemical ferrate synthesis are inadequate, leading to uncertain and sometimes misleading results.

Dual Dynamic Voltammetry (DDV) is a novel method that can be used for Rotating Ring Disk Electrodes (RRDE)[1] experimental setups. DDV makes the simultaneous, independent polarization of the two electrodes (ring and disk) possible. The fast polarization of the Platinum ring and the slow polarization of the Iron disk makes the characterization of the ferrate ion production possible with high resolution, and indifferent to the decomposition of ferrate ions. DDV measurement with non-dissolving disk (Platinum) made the investigation of the separate effect of oxygen evolution possible. Spectrophotometric measurements confirmed the ferrate ion detection at the Platinum ring. Using this setup the formal separation of ferrate ion production and oxygen evolution could be executed, and the ferrate ion formation reaction could be investigated alone.

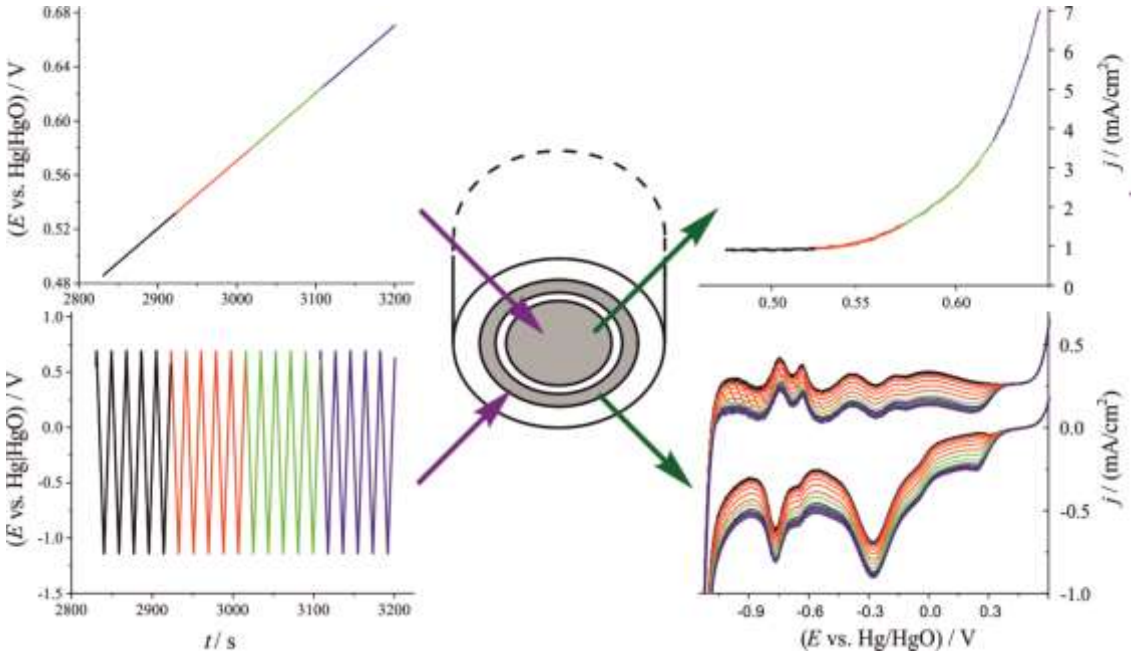

Figure 1. Potential program and voltammogram of the Disk and Ring during a Dual Dynamic Voltammetric (DDV).

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