

Improving the electrocatalytic activity of iron phthalocyanines and porphyrines towards the oxidation of L-cysteine due to the incorporation of multiwall carbon nanotubes and modulation of the Fe(II)/(I) formal potential

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Carbon nanotubes (CNT) have demonstrated to have very attractive properties for the development of hybrid electrodes with application in energy conversion, electronics and sensing, biological applications, etc. [1,2] New strategy making hybrid materials allow to obtain molecular phthalocyanines-CNTs electrodes with properties that differ from one electrode conventionally built, like high specific surface and excellent electronic conductivity.

The phthalocyanines and porphyrines have electrocatalytic activity for a long quantity of reaction including the reduction of molecular oxygen, nitrate, disulfides and for the oxidation of hydrazine, hydroxylamine, thiols, etc. This complex can be strongly adsorbed to graphite and other carbon material like singlewall and multiwall carbon nanotubes [3].

Taking this as an advantage, we developed a hybrid electrode based in the adsorption of iron phthalocyanines (FePc's) and iron porphyrines (FeP's) on multiwall carbon nanotubes deposited over an edge-plane pyrolytic graphite (eppg) electrode for the study of the electrocatalytic oxidation of L-cysteine in basic medium.

We compared the catalytic activity of several complex of FePc's and FeP's substituted acceptors or electron density donors deposited on bare eppg (eppg/FePc's or FeP's) and pre-adsorbed on MWCNT and deposited on eppg (eppg/MWCNT FePc's or FeP's). In this way we obtained an improve in the catalytic activity of the "eppg/MWCNT FePc's or FeP's" electrodes compared with the "eppg/FePc's or FeP's" as well an increase in the current values. The eppg and eppg-CNT presents low activity in more positive potentials (Fig 1a). A correlation of $\log I$ (at constant potential) vs. the formal potential E° Fe (II)/(I) of the catalysts gives a volcano correlation with a maximum of activity in -0.3 V (Fig 1b).

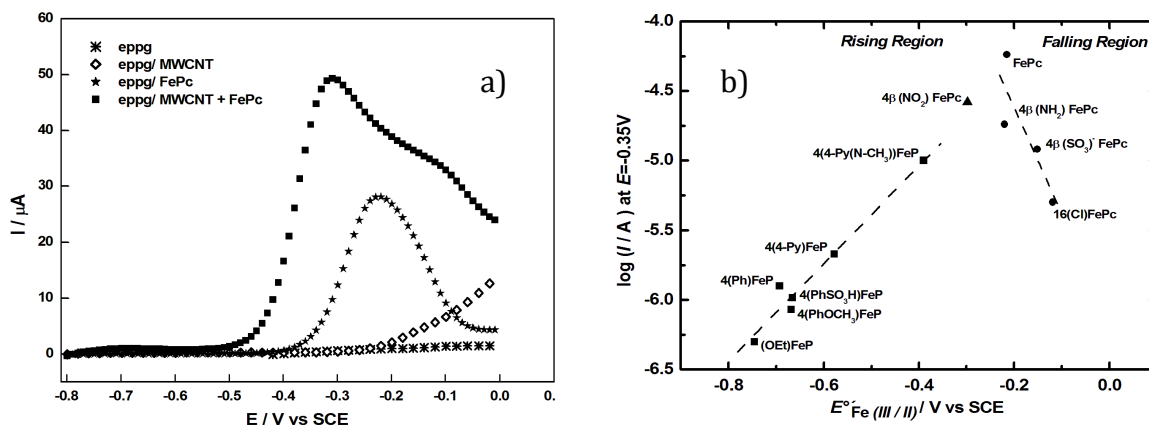


Fig. 1 Polarization curves of oxidation of L-cysteine in 0.2 M. NaOH for different electrodes configurations **a)** and $\log I$ vs. the formal potential of E° Fe (II)/(I) on Eppg electrode modified with MWCNT functionalized with N-4 macrocicles pre-adsorbed ($E = -0.35$ V vs SCE) **b).**

References: **1)** J. Wang, M. Li, Z. Shi, N. Li, Z. Gu, *Electroanalysis*. 14 (2002) 225.; **2)** Iijima, S. *Nature* 354 (1991) 56.; **3)** J.H.Zagal. S. Griveau.. J.F. Silva. Tniokong, and F. Bedioui, *Coord. Chem. Revs.*, 254, 2755 (2010).

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