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Influence of nitrogen on boron doped diamond electrodes in the nitrate electrochemical response

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Diamond films grown by chemical vapor deposition has been optimized during recent years because of their excellent physico-chemical properties. Due to its wide working potential window and high corrosion resistance, diamond electrodes have been proposed to be beneficial in a range of electroanalytical applications, which are depending of the material aspects¹. One of these aspects is the film doping, which can be carried out using boron or nitrogen to turn the diamond films as a semiconductor. Boron doped diamond (BDD) electrodes has been already studied as a new material with extraordinary properties that turn them as a chemical sensors². Particularly, high overpotential presented by BDD electrodes for hydrogen evolution has demonstrated to be a decisive attribute for studying the detection and reduction of several chemical species. Besides, the nitrogen addition during the BDD growth process (N and B co-doped electrodes) may also enhance this cathodic overpotential³. This work presents the influence of nitrogen on BDD electrodes in response of nitrate ions reduction. Actually, the large use of nitrogen-based compounds in agriculture has increased their ion concentration in the biosphere promoting a significant pollution problem. The working potential window of the N and B co-doped diamond electrode in 1.0 M H₂SO₄ (Fig. 1A) about of 3.0 V, justifies their performance improvement for nitrate reduction and detection. Furthermore, the variation of N₂ concentration during the BDD growth process was crucial in their electrochemical behavior. Increasing the N₂ concentration favored the occurrence of the nitrate reduction without the interference of hydrogen evolution reaction (Fig. 1B).

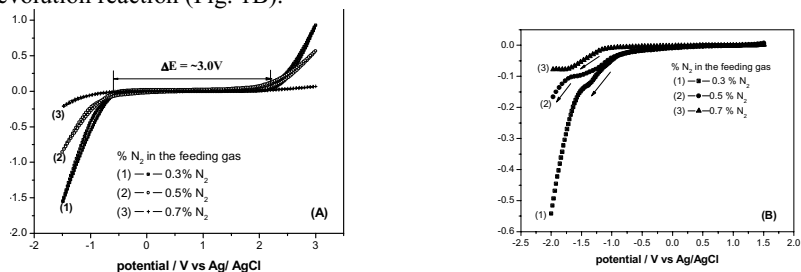


Fig 1: (A) cyclic voltammograms and (B) linear sweep voltammograms of nitrate reduction for the BDD electrodes grown in different N₂ concentration. Solutions used (a) 1.0 M H₂SO₄ and (B) 0,1 M KNO₃ and scan rate at 0,1 Vs⁻¹

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