MORPHOLOGICAL AND ELECTROCHEMICAL STUDIES OF SPHERICAL BORON DOPED DIAMOND (SBDD) ELECTRODES

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In this work a boron doped diamond (BDD) electrode with a new geometric form is presented[1]. CVD diamond films with boron doping of 10,000 ppm were deposited on a spherical substrate previously prepared by laser texturized. The purpose of this study was to evaluate the morphology, crystalline size and film quality and to establish a comparison between the electrochemical performance of the spherical boron doped diamond electrode **(SBDD)** with that presented by plane boron doped diamond electrode (PBDD), obtained from similar experimental parameters.

Fig.1. shows diamond film deposited on the spherical substrate. Films micrographs by Scanning Electron Microscopy (SEM) showed that grains are faceted with uniform texture and a surface morphology with predominant (111) orientation. Grains with 5-10 µm (average size) were obtained on the all surface. The film texture promotes a surface area increase for electrochemical applications.

It was possible, using Raman spectroscopy, to evaluate the diamond film quality. **Fig.2** shows a diamond film Raman spectrum. It was observed the characteristic diamond line at 1.332 cm^{-1}, a broad band centered at 1550 cm^{-1} that corresponds to sp^2 bonded graphite and a boad peak at 1220 cm^{-1} attributed to the relaxation of the $\Delta k=0$ selection rule caused by the small coherence length of diamond crystallites[2] [24-26].

Finally, the performance of these electrodes in $[Fe(CN)_6]^{3-/4-}$ redox couple was compared with that obtained using PDDE. **Fig. 3** shows that the capacitance of SDDE is a little higher that that observed at PDDE. This fact, together another characteristics of the diamond material[3], explain the good performance presented by BDD electrodes in the electro-synthesis and electro-analysis fields[4]. In contrast with PDDE, it is important to point out that the surface of SDDE is not homogeneous and contains some "holes", produced during the pretreatment of the molybdenum substrate by laser texturized, which are totally recovered with diamond after the growth process. In conclusion, the majority of the electrochemical active area of the SDDE is formed by the holes and the superficial planar regions are so small. The goal now is to make use of these properties in the electro-analysis field.

References:
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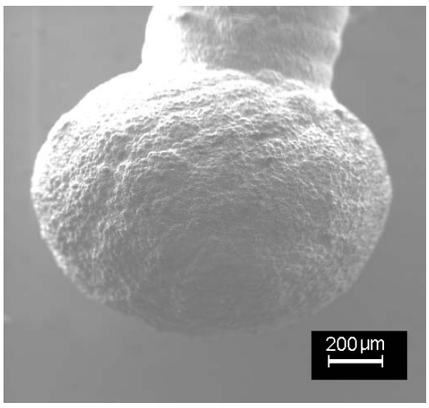

Figure 1. SEM micrograph of boron doped diamond film with 10,000 ppm deposited on the spherical tipped molybdenum rods.

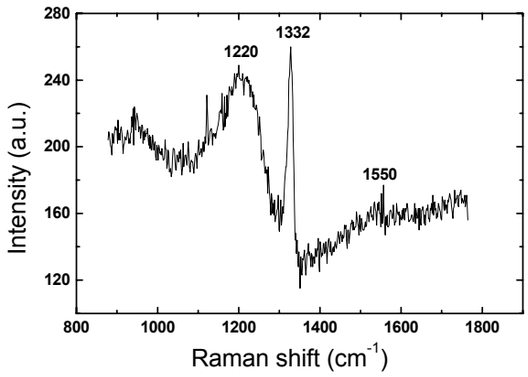

Figure 2. Raman spectrum of diamond film growth with 10,000 ppm of the doping level.

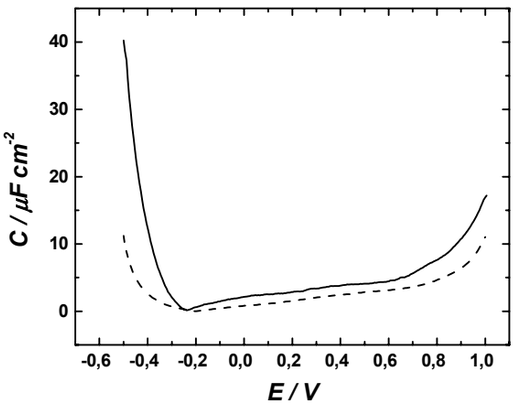

Figure 3. Diamond electrode capacitances as a function of the applied potential: (—) Spherical doped diamond electrode (SDDE), and (– – –) plane doped diamond electrode (PDDE).