CVD DIAMOND AND CARBON NANOTUBES NANOCOMPOSITES PRODUCTION AND APPLICATIONS

Evaldo José Corat[1]*, Romário Araújo Pinheiro[1], Cintia Macedo de Lima[2,3], Bruna C. Lourenção[4], Orlando Fatibello Filho[4], Marcos H. Mamoru O. Hamanaka[5] and Vladimir J. Trava-Airoldi[1]
[1]Intistuto Nacional de Pesquisas Espaciais, São José dos Campos, SP, Brazil
[2]Universidade Federal de São Paulo, São José dos Campos, SP, Brazil
[3]Instituto Federal de São Paulo, Bragança Paulista, SP, Brazil
[4]Universidade Federal de São Carlos, São Carlos, SP, Brazil
[5]Centro de Pesquisas Renato Archer, Campinas, SP, Brazil

1. Introduction

CVD diamond deposition on carbon nanotubes (CNT) has been studied for nearly 10 years, to gain synergy between both excellent materials properties. Most alternatives get a relevant synergy, but fail to preserve CNT nanometric structure. In this work, we show nanocomposites that preserve the original CNT structure to produce superior results, both in porous boron doped diamond (p-BDD) electrodes for electrochemistry and in electrons field emission [1].

2. Experimental

A modified Electrostatic Self Assembly (ESA) method provided the CNT seeding with nanodiamond (ND) particles. In this ESA method CNT oxidation introduced polar groups on its surface giving an anionic character to attract ND particles that have a cationic character. ND particles dispersed in a KCl solution, which supernatant was further diluted 10 times, produced the right amount for a subtle ND seeding of CNT upon submersion of oxidized CNT for few seconds. Short CVD diamond growth periods in Hot Filament Chemical Vapor Deposition (HFCVD) produced porous diamond surfaces closely resembling CNT morphology. BDD growth followed by bubbling hydrogen in a solution of boron oxide in methanol to mix to a CH_4/H2 gas mixture. Nitrogen doped diamond (NDD) growth replaces to urea in the methanol solution. Nanocomposites characterization involved field emission gun scanning electron microscopy (FEG-SEM) and Raman scattering spectroscopy (RSS). p-BDD electrodes were tested by cyclic voltammetry, electrochemical impedance spectroscopy and flow injection analysis. The NDD/CNT samples were tested for field emission.

3. Results and Discussions

Figure 1 shows the morphology of p-BDD electrode which resembles closely the original CNT morphology. CNT are covered by a thin diamond layer. p-BDD results show a surface area up to 400 times larger than an equivalent flat BDD electrode. Besides its viability as a large area electrode, its high sensitivity was shown by flow injection analysis. The field emission from NDD/CNT shows a threshold electron field as low as 0.75 V/µm, much lower than the best results in literature.

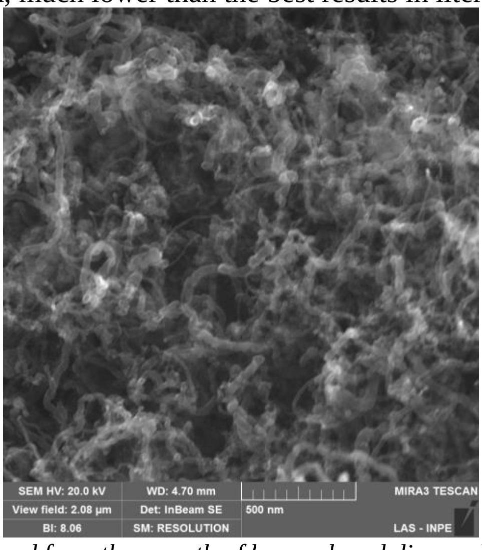

Figure1. *p-BDD diamond from the growth of boron doped diamond on carbon nanotubes.*

4. References

[1] RA Pinheiro, CM de Lima, LDR Cardoso, VJ Trava-Airoldi, EJ Corat – Diam. Relat. Mater. **65**(2016) 198.

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*evaldo.corat@inpe.br