CARBON NANOHORNS AND THEIR NANOCOMPOSITES: SYNTHESIS, PROPERTIES AND APPLICATIONS. A CONCISE REVIEW

Bogdan-Catalin SERBAN[1], Marius BUMBAC[2], Octavian BUIU[1],
Cornel COBIANU[1,], Mihai BREZEANU[3], Cristina NICOLESCU[4]

Abstract. *Single-walled carbon nanohorns (SWCNHs) are a kind of nanocarbon materials consist of horn-shaped sheath aggregate of graphene sheets. SWCNHs are generally synthesized with high yield by CO_2 laser ablation technique of graphite target without a metal catalyst. The SWCNHs reveal interesting properties such as high conductivity, high dispersibility, large specific surface area, etc. Nowadays, SWCNHs and their nanocomposites have been widely investigated for different applications such as energy management system (supercapacitor, photovoltaics, Li-Ion batteries, fuel cell), additive for improvement of electrical and mechanical properties of nanocomposites, electrochemical biosensing, gas adsorption and gas storage, catalyst support, medical (drug delivery system), gas sensing application and so on. The purpose of this paper is to review the recent research on single-walled carbon nanohorns and their nanocomposites including synthesis, properties, covalent and noncovalent functionalization and utilization.*

Keywords: Single-walled carbon nanohorns, laser ablation, functionalization, ethanol sensing, capacitor.

1. Introduction

Along with carbon nanotubes [1], fullerenes [2] and graphene [3, 4] a new nanocarbon material structure, the single walled nanohorns (SWCNHs), were discovered by Iijima in 1998 [5]. Harris, Tsang, Claridge and Green observed in 1994 very similar carbon - based molecular architecture [6]. SWNHs are conical carbon nanostructures constructed from a sp^2 carbon sheet of about 2-5 nm of diameter and 30 to 50 nm long (see Figure 1). Three different types of single-walled carbon nanohorns structure were observed: 'dahlia-like', 'bud-like' and 'seed-like' [7]. Synthesis of nanohorns by CO_2 laser ablation of graphite require no metal catalyst.

[1]National Institute for Research and Development in Microtechnologies, IMT-Bucharest, Romania. Corresponding author: bogdan.serban@imt.ro.
*Full member of the Romanian Academy of Scientists.
[2]Valahia University of Targoviste, Faculty of Sciences and Arts, Sciences and Advanced Technologies Department, Targoviste, Romania.
[3]University Politehnica of Bucharest, Romania.
[4]Valahia University of Targoviste, Institute of Multidisciplinary Research for Science Technology, Targoviste, Romania.