J Nanomed Nanotechnol 2013, 4:6
http://dx.doi.org/10.4172/2157-7439.S1.015

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference on
Nanotek & Expo

December 02-04, 2013 Hampton Inn Tropicana, Las Vegas, NV, USA

Synthesis of carbon nanotubes from carbon waste using plasma techniques

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This study is focused on the design of a novel plasma jet chemical vapour deposition (CVD) reactor for the synthesis of carbon nanotubes (CNTs) using carbon waste. The use of this reactor for the synthesis of these materials was fully described in this study. The process parameters involved such as the pyrolysis temperatures of the plasma torch, the pressure, the nature of the catalyst employed and the carbon source were all discussed. This technique was also investigated for the synthesis of both the single walled and multi walled carbon nanotubes, and the optimization of the process parameters for both syntheses was also investigated.

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Gold: A nano-catalyst

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Traditionally gold metal has been known as inert substance. However, since last two decades there is a significant evidence as its tremendous role as a various source such as catalysis, biomaterials etc. However, not yet a single study is found that may depict the mechanistic role of the presence of gold. This talk aims on how to prepare gold catalysis via novel hydrothermal solution deposition precipitation on impregnated support/carrier as well as its characterization before and after catalytic activity/reaction. It was revealed that there exist mechanistic implications of various sources of oxidant, coming from mixed oxide support, and each has impact on each other. Presence of either nano gold and/or promoter such as manganese had marked a significant competition among the various sources of either lattice or free oxygen. Based on the result a new mechanistic approach is discussed and a preliminary model of catalytic reaction mechanism is proposed. In short, presence of gold not only enhanced the catalytic activity as well as it facilitates the promoter to promote the catalytic activity.

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Self-assembly of catalytic nanomotors and their manipulation under external stimuli

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Making a nanomotor has been a dream of many researchers in the field of nanotechnology often associated with futuristic visions of building "tiny cars", "aircrafts" or "submarines" as small as bacteria or "microscopic surgeons" able to reach infected organs and cure diseases. From molecular machines to micron size self-propelling rods chemists used a combination of bottom-up or top-down approaches often involving intricate synthetic routes which took years of hard synthetic work and at the end with limited control over the directionality of the movement and restricted applicability.

Herein, we report a supramolecular approach to design a nanomotors using self-assembly of amphiphilic block copolymers as a primary tool to construct bowl shape polymersomes entrapping platinum nanoparticles and catalysis as a driving force for the autonomous movement. The movement of the nanomotor is driven by the fast discharge of jet gases (oxygen) just like a miniature nanorocket. The gases are produced during the catalytic decomposition of the fuel (hydrogen peroxide) inside the nanocavity where the active nanoparticle (motor) is entrapped. Insight into the mechanism of movement, applications and further manipulation of the nanomotors under external stimuli will be discussed.

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