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

Chemical and electrochemical synthesis of surface modified graphene for energy storage application

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Surface functional groups play an important role in determining the specific capacitance behavior of graphene. In chemical synthesis, surface modified graphene was derived from graphene oxide (GO) modified with different modifying agents such as sulfonated poly-ether-ether ketone (SPEEK), sodium 4-aminoazobenzene-4'-sulfonate (SAS), its aryl diazonium salt (ADS) and sodium poly-styrene sulfonate (PSS). The surface modified GO was reduced using hydrazine monohydrate in aqueous media. Similarly, one-step electrochemical exfoliation of graphite was employed to obtain surface modified graphene. In comparison to chemical methods, electrochemical synthesis is cost-effective and devoid the use of toxic and hazardous chemicals. Moreover, the defect content in electrochemically obtained graphene was relatively lower than that of chemically derived graphene. The surface modifier used in the electrochemical exfoliation of graphite actively played an additional role as electrolyte during the electrolysis experiment. 9-anthralene carboxylic acid (9ACA), 6-amino-4-hydroxy-2-naphthalenesulfonic acid (ANS) and SPEEK were served the dual role as electrolyte and surface modifier. X-ray diffraction (XRD), Transmission electron microscopy (TEM), Atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), Raman spectroscopy, Fourier transform infrared spectroscopy (FT-IR), UV-Vis spectroscopy, etc. were used to analyze the structural and morphological features of synthesized graphene. Thermal stability was also determined by Thermogravimetric analysis (TGA). Electrochemical performances were evaluated by Cyclic voltammetry (CV), charge-discharge and electrochemical impedance spectroscopy analysis. The specific capacitance of different graphene varied from 250-476 F g^{-1} at low current density. The electrochemical stabilities of graphene were determined by 1000 charge-discharge cycles suggesting its utility as green energy storage electrode materials.

Biography

Tapas Kuila is working as a DST Inspire Faculty at CSIR-Central Mechanical Engineering Research Institute, Durgapur since November-2012. He did his Postdoctoral Research in the Department of BIN Fusion Technology, Chonbuk National University since September, 2009. He received his Ph.D. in Chemistry from Indian Institute of Technology Kharagpur, India. Presently, he is working on the surface modification of chemically derived graphene and its application in supercapacitor devices. He has published more than 45 scientific articles in different peer-reviewed journal.

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Direct decomposition of N_2O over pure and alkali-doped nano-crystalline Co_3O_4 prepared by combustion method

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Nitrous oxide is considered to be a greenhouse gas with global warming potential of c.a. 300. As a source of other nitrogen oxides in the stratosphere, it also contributes to ozone layer depletion. It is emitted from both natural and anthropogenic sources such as nitric acid and adipic acid plants and fluidized bed combustors for sewage-sludge or industrial wastes besides the medical exhaust as well as biological and agricultural emissions. Due to its harmful impact on environment, catalytic decomposition of N_2O received an increased attention during the past several years. Since one of the important anthropogenic sources of N_2O is the nitric acid industry, an efficient low-cost catalyst for this application needs to be developed rather urgently.

This investigation includes, studying the decomposition of nitrous oxide (N_2O) on pure and alkali-doped nano-crystalline Co_3O_4 catalysts prepared via combustion method. Glycine has been used as a combustion fuel. It was found that the activity of the pure nano-crystalline Co_3O_4 catalyst strongly depended on the amount of glycine used in the preparation procedure. The influence of alkali cation promoters (Li, Na, K, and Cs) on the activity of nano-crystalline Co_3O_4 was also investigated. The sequence of the promotional effect was found to be: un-promoted <Cs<Na<Li<K-promoted catalyst. The reason for the increase in activity for the added alkali cations was electronic in nature.

Biography

Tharwat Hassan Mohammed Mansoure has completed his master's degree at the age of 26 years from Assiut University. He has published 5 papers in reputed journals in the field of nano-science and nano-catalysis. He has participated in three international conferences through the last two years, one of them in Poland. Now, he plans to attend graduate school to conduct research leading to Ph.D. in the field of nano-science and nanotechnology where his background and skills could be utilized and developed.

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