

## SEPARATION OF SURFACTANTS FUNCTIONALIZED SINGLE-WALLED CARBON NANOTUBES VIA GRADIENT AGAROSE GEL ELECTROPHORESIS METHOD

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This work presents the single-walled carbon nanotubes (SWCNTs) separation according to the electrical properties and diameter. The SWCNTs were synthesized via laser ablation process with Ni/Co catalysts. The raw material was purified from the residual catalysts particles through threefold refluxing processes in nitric acid. The oxidation debris was removed by multiple washings with sodium hydroxide and hydrochloric acid. Introduced surface functionalities were removed via high temperature vacuum annealing. The pristine sample was dispersed in 2% surfactant solution (3:2) of sodium dodecyl sulfate (SDS) and sodium cholate acid (SCA) at ultrasound bath. The functionalized sample was separated according to the electrical properties and diameter via gradient agarose gel electrophoresis (GAGE). Both applied surfactants are known to present selectivity toward one electronic type of tubes which allows metallic / semiconducting (M/S) separation. Additionally, the linear gradient agarose gel with different density of gel cells works like molecular sieve, which allows to separate the bundles and individual tubes according to their size and diameter. Recovered SWCNT fractions were purified from adsorbed agarose and surfactant impurities via weak acid etching and subsequent annealing. The acid etching was found as a crucial step of post-separation procedure. Therefore, many oxidizing agents were investigated and purification from agarose procedure was optimized. At each step of preparation SWCNTs were analyzed via Raman measurements. The diameter and M/S separation yield were investigated via Raman in RBM range and optical absorption spectroscopies, respectively.

## **SYNTHESIS OF STRUCTURES WITH 0.1 TO 1 NM IN SIZE AND WITH A COUNTABLE NUMBER OF ATOMS.**

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An basic molecular backbone was constructed using short chains of poly-lysine peptides together with cross-linking reagents. This basic structure worked as an anchor around which an exact number of monodisperse dendrites were covalently bounded. The exact number  $N$  of atoms (predominantly C, H, and N) is given by the following expression:  $N = n \cdot 2^{\exp(G+2)}$ . Where  $n$  is number of anchoring sites on the poli-lysine backbone and  $G$  is the generation of the dendrites used.

## RESISTIVE MEMORY BASED ON GRAPHENE OXIDE PREPARED IN SUPERCRITICAL CO<sub>2</sub>

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In this study, the authors report a novel method to prepare graphene oxide (GO) by intercalating, exfoliating, and oxidating layered graphite in supercritical CO<sub>2</sub> (scCO<sub>2</sub>) system with the assisted intercalating of surfactant and oxidation of H<sub>2</sub>O<sub>2</sub>. First, graphitic material, surfactant, and H<sub>2</sub>O<sub>2</sub> were put into a scCO<sub>2</sub> chamber with magnetic stirring at a certain temperature and pressure for a period of time and then rapidly depressurizing the fluid at a fluid release rate sufficient for effecting exfoliation of the graphitic material to obtain the nano graphene platelets (NGPs). In order to exfoliate and oxidate the graphite completely, the above process repeated three times. Thermogravimetric analysis, X-ray photoelectron spectroscopy, and Raman spectroscopy results indicated the successful preparation of GO platelets. Atomic force microscopy (AFM) was used to measure thickness and the structure of produced GO. GO films dissolved in organic solvent or water were deposited on SiO<sub>2</sub>/Si wafers by spin coating at 1000-3000 RPM to measure the film uniformity. AFM height profiles revealed that the film is very uniform, the thickness ranging from 1-2 layers to multilayers. And the very thin films can be lifted off to form uniform membranes that can be free-standing or transferred onto any substrates. In order to verify the performance of resistive memory based on GO, an Al/GO/ITO device with good reliable and reproducible resistive switching behaviors was fabricated. Electrical measurements based on the Al/GO/ITO structure device showed an on/off ratio more than 10<sup>3</sup>, low set/reset voltage, and excellent data retention. The GO memory is also fabricated on a flexible substrate and the measuring results demonstrated no degradation in switching property when the substrate is bent down to the radius less than 1cm, indicating that the GO memory is an excellent candidate to be a memory device for future flexible electronics.

## DUAL COORDINATION MODES OF ETHYLENE-LINKED NP2 LIGANDS IN COBALT(II) AND NICKEL(II) IODIDES

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Complexes containing late transition metals bound to phosphine donors have found application in a wide variety of industrial transformations and synthetic methodologies. Phosphorus ligands are of interest because they stabilize low oxidation states ( $M^{II}$ ) that are active species in many catalytic cycles, and cobalt phosphines promote ethylene polymerization<sup>1</sup> and hydroformylation reactions.<sup>2-4</sup> In the case of mixed phosphorus- and nitrogen-containing ligands, the additional functionality of an N-donor can allow the metal center to access a greater range of oxidation states than with phosphines alone. We have investigated NP2 complexes of two transition metals *in the same oxidation state* ( $Ni^{II}$  and  $Co^{II}$ ) that typically adopt different coordination geometries (square planar and tetrahedral, respectively). Here we report that **NP2** ligands with *para*-substituted benzylamines and aniline as N-substituent can adopt dual binding motifs when bound to  $Co^{II}$ , designated NP2 and NP2, where the donor atoms are underlined. We have explored the solid and solution state properties of the  $Co^{II}$  complexes by X-ray, SQUID and EPR methods. The corresponding  $Ni^{II}$  complexes are all square planar with NP2 coordination.