(lengths), but have a high electrostatic potential and thus agglomerate, forming bundles of 10 - >100 nanotubes – so-called "nanoropes". Workplace exposure assessmant studies have reported very low respirable concentrations (i.e., < 0.1 mg/m3). Intratracheal instillation exposures of SWCNT into the lungs of rats or mice have produced foreign tissue body reactions in the lung, however, because of agglomeration factors, the physiological relevance of these results are questionable, and must be validated via an inhalation study. More recently, we have tested the "nanoparticle hypothesis" of lung toxicity by comparing the effects of nanoquartz particles (50 nm) with fine-sized quartz (– 1.6 um), which has been classified by IARC as a human carcinogen. In addition, we have compared the pulmonary toxicity of low toxicity, fine titanium dioxide particles (~300 nm) vs. nano-sized TIO2 rods and dots (< 50 nm). Our preliminary data suggest that intratracheal instillation of nano-quartz produces less pulmonary inflammation and cytotoxicity in rats when compared to fine-sized quartz particles. In addition, the effects of TIO2 nanodots and rods were not different from fine-sized TIO2 particles, contrary to previous studies comparing P-25 nanoTIO2 to fine-sized TIO2. These preliminary findings suggest that the common perceptions regarding nanoparticulates are more complex than previously considered. Perhaps surface coatings and other factors have some impacts on the lung toxicity of particle-related health effects.

20.
CYTOTOXIC AND GENOTOXIC EFFECTS OF SINGLE WALL CARBON NANOTUBE EXPOSURE ON HUMAN KERATINOCYTES AND BRONCHIAL EPITHELIAL CELLS. *Anna A Shvedova[1], Elena Kisin[2], Nagu Keshava[3], Ashley R Murray[4], Olga Gorelik[5], Sivaram Arepalli[5], Vadim Z Gandelsman[5], and Vincent Castranova[1]. (1) Pathology and Physiology Research Branch/Department of Physiology and Pharmacology, HELD, NIOSH/West Virginia University, 1095 Willowdale Rd, Morgantown, WV 26505, ats1@cdc.gov, (2) Pathology and Physiology Research Branch, HELD, NIOSH, (3) Toxicology and Molecular Biology Branch, HELD, NIOSH, (4) Department of Physiology and Pharmacology, West Virginia University, (5) Materials and Processes Branch/Nanotube Team, Lockheed Martin Corporation/GBTech, Inc., NASA-JSC*

Carbon nanotubes are new members of carbon allotropes similar to fullerenes and graphite. Because of their unique electrical, mechanical and thermal properties, carbon nanotubes are being evaluated for novel applications in electronics, aerospace and computer industries. Occupational exposure to graphite and carbon materials has been associated with increased incidence of skin and lung diseases, e.g., carbon fiber dermatitis, hyperkeratosis, naevi, asthma, pneumoconiosis and cancer. However, the potential toxicity and mechanisms of action of single wall carbon nanotubes (SWCNT) have yet to be determined. The present talk will be focused on adverse effects of SWCNT studied in cell culture models - human epidermal keratinocytes (HaCaT) and bronchial epithelial cells (BEAS-2B). SWCNT caused ultra-structural and morphological changes, loss of cell integrity and apoptosis, accelerated oxidative stress indicated by the formation of carbon-centered and hydroxyl radicals, accumulation of peroxidative products, and depletion of antioxidants in the cells. Transcriptional response to SWCNT in BEAS2 and HaCaT cells detected by microarray analysis revealed alterations of a number of genes including those involved in oxidative stress. These data suggest that exposure to SWCNT may lead to dermal and pulmonary toxicity and identify oxidative stress as one of potentially important mechanisms of cell injury.

21.
TOXICITY OF NC60 FULLERENES TO TWO AQUATIC SPECIES: DAPHNIA AND LARGEMOUTH BASS. ***Eva Oberdörster**, Department of Biology, Southern Methodist University, 6501 Airline Road, Dallas, TX 75275-0376, Fax: 214-768-3955, eoberdor@mail.smu.edu*

The goal of this study was to evaluate whether the nC60 fullerenes induce oxidative stress in two standard aquatic test species. Neonatal daphnids were individually exposed in 40 mL of media augmented with fullerenes in the range of 5 ppb to 2 ppm with a media change every 2-3 days for three weeks (EPA standard test protocol). The 48 hour LC50 for daphnia was 460 ppb as calculated in two separate trials. At 500 ppb and above, the surviving daphnids were delayed in molting and reproduction. Juvenile largemouth bass were exposed to either 0.5 or 1 ppm fullerenes for 48 hours. For both daphnia and bass, lipid peroxidation and protein oxidation were analyzed and compared to a positive control of 100 mM hydrogen peroxide exposure. In addition, large-mouth bass livers from the 1 ppm dose were analyzed by subtractive hybridization for changes in gene expression due to fullerene exposure.

22.
USE OF FLUORESCENTLY LABELED NANOPARTICLES TO DETERMINE THE EFFECT OF PARTICLE SIZE ON TRANSLOCATION FROM THE LUNG. ***Janet M Carter**, Central Product Safety, Procter & Gamble Co, 11810 E. Miami River Rd, Cincinnati, OH 45253, Fax: 513-627-1744, carter.jm.3@pg.com, Edward D Clark. The Health and Environmental Alliance, and Gunter Oberdorster, University of Rochester*

Nanoparticles or ultrafine particles, are particles generally considered to be less than 100nm in size. These particles have been implicated in morbidity and other adverse reactions associated with PM2.5. Due to their small size, these particles may translocate from the lung to remote sites such as the heart, liver, brain or other extrapulmonary organs after inhalation exposure. Additionally, it has been suggested that the translocation of these particles may be responsible for adverse effects from ultrafine particles. We have initiated studies to determine whether nanoparticles translocate to extrapulmonary organs after inhalation of particles in rats. Briefly, Fisher 344 female rats were exposed via an aspiration model to fluorescently labeled polystyrene ranging in size from 20 nm to 400 nm. Animals were sacrificed 1, 3, 7 and 14 days after exposure to nanoparticles. Lung, heart, brain, spleen, kidney and liver tissues were removed and preserved for histological examination. Blood was also collected for examination of nanoparticles. Tissue was examined via confocal microscopy for presence of fluorescent nanoparticles. In vitro experiments using EpiAirway tissue constructs were also performed to evaluate membrane/cell/particle interactions. Histological evaluations were performed on these tissues 2, 8, and 24 hours post exposure. In vivo experiments indicate a correlation between size and the ability of these particles to migrate from the lung after inhalation exposure. Additionally, in vitro data yielded similar findings indicating particle size is a factor in predicting translocation potential of nanosized particles.

23.
MOLECULAR SENSORS FOR ANIONS. ***Eric V. Anslyn**, Department of Chemistry and Biochemistry, The University of Texas, Austin, TX 78712, Fax: 512-471-7791, anslyn@ccwf.cc.utexas.edu*

Anions of biological and commercial interest have a variety of shapes and charges. The creation of highly selective receptors for each anion of interest by rational design is a challenging goal. We will discuss our design strategies, based upon a handful of molecular scaffolds and the use of guanidinium and boronic acid groups. The sensing elements are common pH indicators, but now used in a displacement assay. Further, we will also show how a combination of design and combinatorial synthesis results in a series of differential receptors which together give a fingerprint response for various anions. This second approach to anion sensing has wide spread applications, and is faster and simpler approach to molecular sensing in general.

24.
CHEMICAL SENSORS BASED ON MOLECULAR HOSTS FOR ANIONS. ***Leonidas G. Bachas**, Department of Chemistry, University of Kentucky, 125 Chemistry/Physics Bldg, Rose St., Lexington, KY 40506-0055, bachas@uky.edu*

The selectivity of chemical sensors is primarily determined by the specificity of the employed recognition element. Highly selective cation membrane sensors based on macrocyclic Lewis bases have been developed. In contrast, anion sensors have yet to reach the same level of achievement, due to the slower pace in the development of molecular hosts (ionophores) for anions. Several strategies can be followed in the design of ionophores with optimal selectivity toward a particular anion. The topology of the ionophore and the presence of functional groups that are organized to complement the size and shape of the targeted anion determine the ion-ionophore interactions and consequently the selectivity of the resulting sensors. Examples of ionophores and their use in the development of potentiometric and optical sensors for anions (e.g., chloride and sulfate) will be discussed. Additionally, our most recent efforts in integrating sensors and sensing arrays within microfluidic devices will be presented.

ABSTRACTS OF PAPERS

Part 1

227th ACS National Meeting

0-8412-3924-X

American Chemical Society

Anaheim, CA

March 28—April 1, 2004