ORGANOSILICATE NANOPARTICLES AND ITS APPLICATIONS IN CHEM-BIOSENSORS, ELECTRONICS, MULTIFUCTIONAL COATINGS AND TEXTILES

This invention reports a novel technique for the rapid and cost-efficient synthesis of organosilicate nanoparticles (OSNPs) that have been successfully applied as individual building blocks for various applications. Doping these nanoparticles with fluorescent dyes results in highly fluorescent, biocompatible, water soluble nanoparticles with demonstrated long term photostability and with surface groups that can be readily used to attach various biological moieties. Fluorescent intensity of dye doped OSNPs (22.4 ± 5.3 nm) is shown to be 200 times brighter with 94% of the initial fluorescence intensity retained than the constituent dyes under continuous excitation for 10 minutes. In contrast, under identical test conditions, individual dye molecules retained only 58% of the initial fluorescence demonstrating that these nanoparticles have excellent utility in lifesciences research, forensics, chemical – biological sensors and biological imaging applications.

Through our patented technology of novel bottom up fabrication technique, these nanoparticles have been used to fabricate highly porous transparent films. Optically smooth hydrophobic films with low refractive indices (as low as 1.048) and high surface areas (as high as 1325 m2/g) can be achieved on large area substrates. These unique materials can be readily interfaced with existing immunoassays in the form of inexpensive dip-stick assays for the sensitive detection of chemical and biological warfare agents or novel diagnostic strips for point of care applications. Our preliminary evaluation of these coatings in combination with dye doped OSNPs for construction of diagnostic immunoassays gave ~180 fold enhancement in fluorescence signal enhancement compared to traditional (microscope glass slide and fluorescent dye molecules) based assays.

OSNPs used as filler elements within sol-gel based coatings have been shown to greatly enhance their structural stability, flexibility and wear resistance. Crack-free coatings (with thicknesses exceeding 30 microns)/novel multifunctional electrospun fibers have been successfully achieved by employing OSNP fillers (up to 75% by weight) within sol-gel compositions.

POTENTIAL AREAS OF APPLICATIONS:

- Chemical Biological sensors
- Medical Diagnostics
- Multifunctional coatings
- Next generation Chemical-Biological protection textiles (Soldier technologies)

PATENT STATUS: Non provisional patent application on file

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