Nanomaterials

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Carbon Nanotubes Applications

1. Structural

CNTs possesses remarkable properties and qualities as structural materials. Their potential applications include:

(a) *Concrete*—CNTs in concrete increases its tensile strength and halt crack propagation.

(b) *Body armor*—CNT fibers are being used as combat jackets. The jackets are used to monitor the condition of the wearer and to provide protection from bullets.

Carbon Nanotubes Applications

1. Structural

(c) *Flywheels*—The high strength/weight ratios of CNTs enable very high rotational speeds.

(e) *Sports equipment*—Golf balls, golf clubs, stronger and lighter tennis rackets, bicycle parts, and baseball bats.

(f) *Bridges*—CNTs may be able to replace steel in suspension and bridges.

Carbon Nanotubes Applications

2. Electromagnetic

CNTs can be fabricated as electrical conductors, semiconductors and insulators. Such applications include:

(a) *Light bulb filament*—CNTs can be used as alternative to tungsten filaments in incandescent lamps.

(b) *Magnets*—A strong magnetic field can be generated using multi-walled CNTs coated with magnetite.

Carbon Nanotubes Applications

2. Electromagnetic

(c) *Solar cells*—Germanium CNT diode exploits the photovoltaic effect. In some solar cells, nanotubes are used to replace the ITO (indium tin-oxide) to allow the light to pass to the active layers and generate photocurrent.

(d) *Electromagnetic antenna*—CNTs can act as an antenna for radio and other electromagnetic devices due to its durability, light weight and conductive properties .

Carbon Nanotubes Applications

3. Chemical

CNTs finds tremendous applications in the chemical field also, few of them are as follows:

(a) *Air pollution filter*—CNTs are one of the best materials for air filters because they possess high adsorption capacity and large specific area. The conductance of CNTs changes when polluted gas comes in its contact. This helps in detecting and filtering the polluted air . CNT membranes can successfully filter carbon dioxide from power plant emissions .

Carbon Nanotubes Applications

3. Chemical

(b) *Water filter*—CNT membranes can aid in filtration. It can reduce distillation costs by 75 %. These tubes are so thin that small particles (like water molecules) can pass through them, while blocking larger particles (such as the chloride ions in salt). CNTs have high active site and controlled distribution of pore size on their surface. This increases not only its sorption capabilities, but also its sorption efficiency. CNTs have effective sorption capacity over broad pH range (particularly for 7 to 10 pH).

Carbon Nanotubes Applications

3. Chemical

(c) *Sensors*—CNT based sensors can detect temperature, air pressure, chemical gases (such as carbon monoxide, ammonia), molecular pressure, strain, etc. The operation of a CNT based sensor is primarily dependent on the generation of current/voltage. The electric current is generated by the flow of free charged carrier induced in any material. This charge is typically modulated by the adsorption of a target on the CNT surface. A CNT based fabricated gas sensing device is shown in Fig.14.

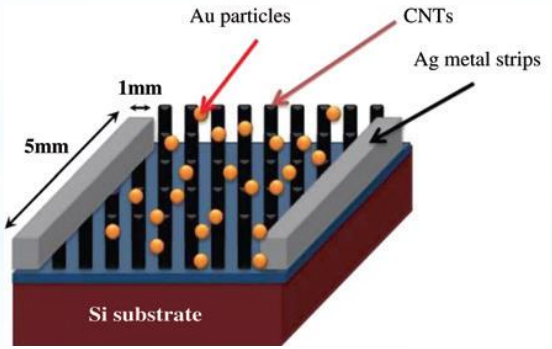

Fig. 14 Fabricated gas sensing device