National Aeronautics and Space Administration

Coated or Doped Carbon Nanotube Network Sensors as affected by Environmental Parameters

This invention is available for licensing out of NASA's space program to benefit U.S. industry. This invention relates to the use of carbon nanotube networks as sensors of chemical substances. Chemical sensors have been developed for decades to detect gases and vapors at various concentration levels for deployment in a wide range of industrial applications. The detection usually centers on a change of a particular property or status of the sensing material (such as temperature, electrical, optical characteristics, etc.). Other types of sensors include electrochemical cells, conducting polymer sensors, surface acoustic wave sensors, and catalytic bead sensors. Sensors based on the emerging field of nanotechnology promise to provide improved performance on all of the above compared to current micro and macro sensors. Among the numerous nanomaterials available, carbon nanotubes (CNTs) have received significant attention due to their unique electronic and extra-ordinary mechanical properties.

Technology Details

The invention, using Carbon Nanotubes (CNTs) provides a chemical sensor or sensor array for detecting presence, at or near room temperature, of one or more of N target gas components or molecules ($N \geq 1$) in a gas mixture contained in a chamber, by any ambient environment being considered. The sensor contains a network of single wall carbon nanotubes (SWCNTs) that is connected to a controllably variable voltage difference or current source. The chamber may be closed, isolated, and static; or, preferably, may allow gas flow-through and thus not be wholly isolated from the external environment. Alternatively, the chamber may be part or all of the external environment. Carbon nanotubes coated with different polymer can provide specific interactions with a chemical species of interest. As this chemical treatment aims to provide a specific interaction between the carbon nanotube matrix and specific gas molecules, the treatment can improve the selectivity while maintaining the high sensitivity expected of a nanosensor.

Commercial Applications

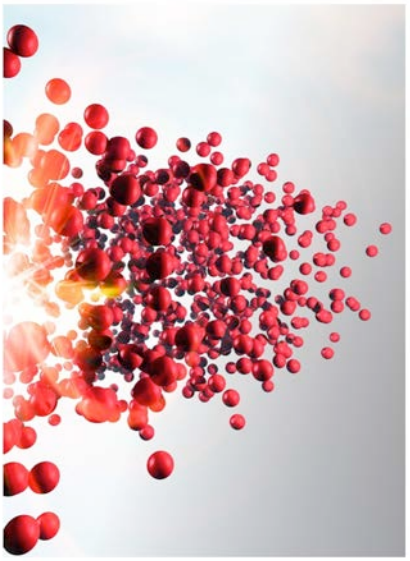
- Environmental monitoring
- Medical diagnosis
- Gas/vapor detection
- Homeland Security & Defense
- Food and Agriculture
- Gas leak detection

Patents

This technology has been patented. U.S. Patent No. 8,000,903 (Reference No. ARC-15566-2).

Benefits

- High sensitivity sensors (ppm-ppb)
- Low power consumption
- Room temperature operation
- Rapid response time
- High selectivity
- Long term stability
- Sustain chemical reactivity
- Unique electronic properties
- Extraordinary mechanical properties
- Increased adsorptive capacity for gasses and vapors
- Improved performance



An illustration of Smartdust representing sensors, robots, or other devices that can detect for example light, temperature, vibration, magnetism, or chemicals.

Contact the Ames Technology Partnerships Office at 1-855-627-2249 or ARC-TechTransfer@mail.nasa.gov