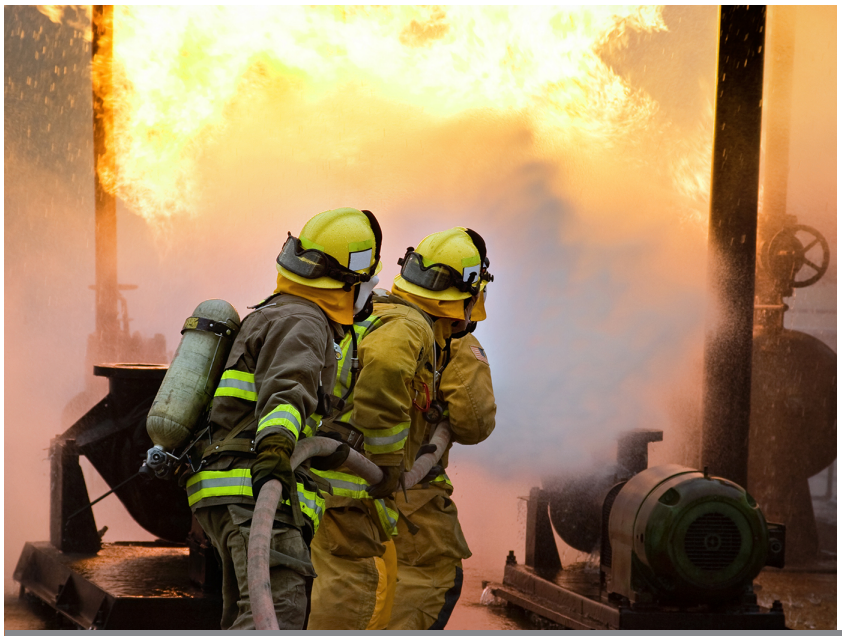

National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Electrical and Electronics

Polymer Nanofiber-Based Reversible Nano-Switch/Sensor Schottky Diode Device

Novel microsensor signals when toxic gases or ultraviolet radiation is present

Innovators at NASA's Glenn Research Center have developed a unique nanostructure device that operates as a nano-switch/sensor for detecting toxic gases and ultraviolet (UV) radiation. Conventional microsensors are limited by their short life, high cost and complexity, and unifunctional sensing task. Glenn's novel Polymer Nanofiber-Based Reversible Nano-Switch/Sensor Schottky Diode (nanoSSSD) technology offers the ability to respond to changing conditions and then revert to baseline operations when conditions return to normal. Glenn's nanoSSSD features no mechanical moving parts, and the sensors are reusable after annealing, extending their appeal for rapid-response, low-cost devices. This simple design provides an easily fabricated, mass-producible microsensor for use in numerous applications where replacement opportunities are limited.

BENEFITS

- Reliable: Allows for simpler fabrication processes and stronger materials
- Robust: Withstands harsh, extreme environments
- Versatile: Operates as both a sensor and a switch, with self-actuating signaling
- Flexible: Offers enhanced compatibility with other silicon-based circuits, using an n-doped or p-doped substrate as needed
- Economical: Fabricated using standard semiconductor-device processing techniques

THE TECHNOLOGY

Glenn's innovative nanoSSSD device includes a doped semiconducting substrate, an insulating layer deposited on the substrate, an electrode formed on the insulating layer, and at least one polymer nanofiber deposited on the electrode. The deposited nanofiber provides an electrical connection between the electrode and the substrate, serving as the electro-active element in the device. The nanofiber is generally composed of a customized polymer (e.g., polyaniline) that is extremely sensitive to the adsorption and desorption of a single gas molecule. As gas molecules are adsorbed and desorbed, the resistivity of the customized polymer also changes, providing its sensing capacity. When the nanoSSSD device senses a selected gaseous species, the switching portion of the device automatically actuates, sending a signal to the control component. This control component activates the output (warning) device. In addition to its ability to detect harmful gases (including ammonia, hydrogen, hydrocarbons, nitrogen oxides, carbon monoxide, and carbon dioxide), Glenn's device can also feature conducting polymers that are sensitive to UV radiation. Glenn's nanoSSSD technology has great commercial potential, particularly in situations where frequent replacement of the switch/sensor is impractical.

Glenn's polymer nanofiber-based switch/sensor can be added to security screening technology to detect toxic gases, such as those in explosive or flammable substances

The nanoSSSD's UV sensor capability can help users avoid overexposure to the sun

APPLICATIONS

The technology has several potential applications:

- Security
- Environmental monitoring
- Biomedical
- Remote sensing

PUBLICATIONS

Patent No: 9,753,001; 10,067,080

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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