ameter of the nanowires to be grown from the pillar faces. The aggregation is effected by heating the workpiece in an inert atmosphere.

The pillar array can then be used as a reference mark for straightforward device fabrication in a process called alignment. Knowing the position of the silicon nanowires avoids the present difficulties of working with random or semi-random distributions of silicon nanowires. In an important class of potential applications, nanobridges would be coated with biomolecules (e.g., antigens) that bind to other biomolecules of interest (e.g., the antibodies corresponding to the antigens) to enable highly sensitive detection of the molecules of interest. Sensors comprising arrays of multiplexed nanobridges functionalized for detection of proteins symptomatic of cancer have already been demonstrated to be feasible.

This work was done by Stephanie A Getty of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). *GSC-15368-1*

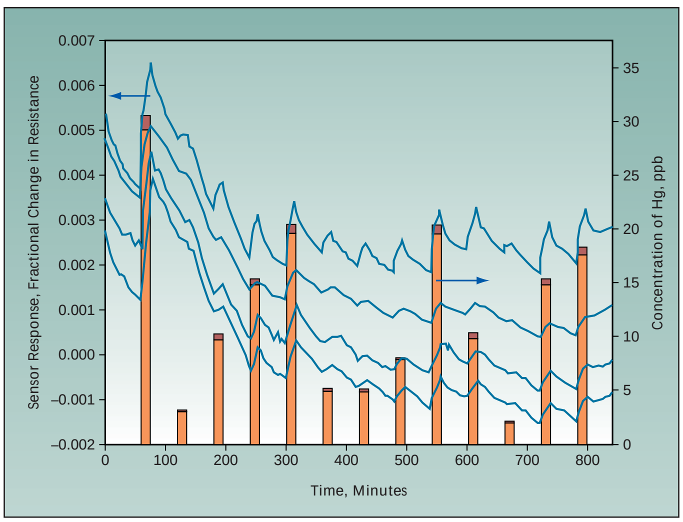
Detecting Airborne Mercury by Use of Gold Nanowires

Mercury has been detected at concentrations as low as 2 ppb.

NASA's Jet Propulsion Laboratory, Pasadena, California

Like the palladium chloride ($PdCl_2$) films described in the immediately preceding article, gold nanowire sensors have been found to be useful for detecting airborne elemental mercury at concentrations on the order of parts per billion (ppb). Also like the $PdCl_2$ films, gold nanowire sensors can be regenerated under conditions much milder than those necessary for regeneration of gold films that have been used as airborne-Hg sensors. The interest in nanowire sensors in general is prompted by the expectation that nanowires of a given material covering a given surface may exhibit greater sensitivity than does a film of the same material because nanowires have a greater surface area.

In preparation for experiments to demonstrate this sensor concept, sensors were fabricated by depositing gold nanowires, variously, on microhotplate or microarray sensor substrates. In the experiments, the electrical resistances were measured while the sensors were exposed to air at a temperature of 25 °C and relative humidity of about 30 percent containing mercury at various concentrations from 2 to 70 ppb (see figure). The results of this and other experiments have been interpreted as signifying that sensors of this type can detect mercury at ppb concentrations in room-temperature air and can be regenerated by exposure to clean flowing air at temperatures <40 °C.



Four Gold-Nanowire-Mat Sensors were exposed to various concentrations of Hg in air at a temperature of 25 °C and a relative humidity of about 30 percent.

The responses of the experimental sensors were found to be repeatable over a period of about 4 months, to vary approximately linearly with concentration from 2 to 20 ppb, and to vary somewhat nonlinearly with concentration above 20 ppb. Although mercury concentrations were found to be measurable down to 2 ppb, the limit of sensitivity may be lower than 2 ppb: Experiments at lower concentrations had not yet been performed at the time of reporting the information for this article.

This work was done by Margaret Ryan, Abhijit Shevade, Adam Kisor, and Margie Homer of Caltech; Jessica Soler of Glendale City College; and Nosang Myung and Megan Nix of the University of California, Riverside, for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). *NPO-44787*

Detecting Airborne Mercury by Use of Palladium Chloride

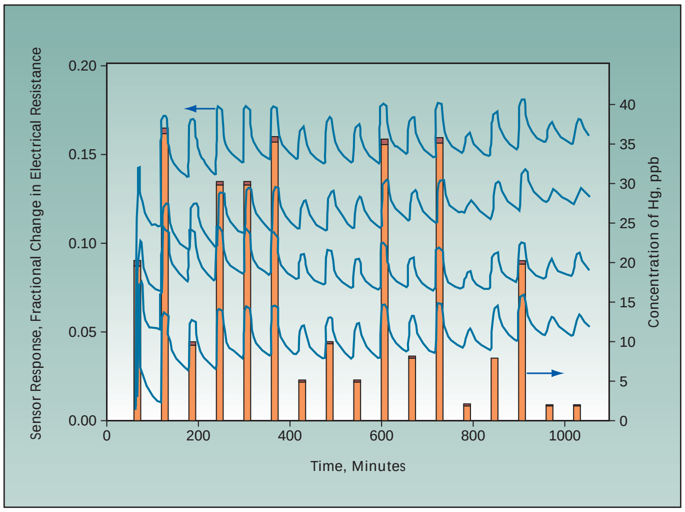
These sensors can be regenerated under relatively mild conditions.

NASA's Jet Propulsion Laboratory, Pasadena, California

Palladium chloride films have been found to be useful as alternatives to the gold films heretofore used to detect airborne elemental mercury at concentrations of the order of parts per billion (ppb). Somewhat more specifically, when suitably prepared palladium chloride films are exposed to parts-per-billion or larger concentrations of airborne mercury, their electrical resistances change by amounts large enough to be easily measurable. Because airborne mercury adversely affects health, it is desirable to be able to detect it with high sensitivity, especially in enclosed environments in which there is a risk of leakage of mercury from lamps or other equipment.

The detection of mercury by use of gold films involves the formation of gold/mercury amalgam. Gold films offer adequate sensitivity for detection of airborne mercury and could easily be integrated into an electronic-nose system designed to operate in the temperature range of 23 to 28 °C. Unfortunately, in order to regenerate a gold-film mercury sensor, one must heat it to a temperature of 200 °C for several minutes in clean flowing air.

In preparation for an experiment to demonstrate the present sensor concept, palladium chloride was deposited from an aqueous solution onto sets of gold electrodes and sintered in air to form a film. Then while using the gold electrodes to measure the electrical resistance of the films, the films were exposed, at a temperature of 25 °C, to humidified air containing mercury at various concentrations from 0 to 35 ppb (see figure). The results of this and other experiments have been interpreted as signifying that sensors of this type can detect mercury in room-temperature air at concentrations of at least 2.5 ppb and can readily be regenerated at temperatures <40 °C.



Four $PdCl_2$-Film Sensors were exposed to various concentrations of Hg in air at a temperature of 25 °C and a relative humidity of 31 percent.

This work was done by Margaret Ryan, Abhijit Shevade, Adam Kisor, Margie Homer, and April Jewell of Caltech; Kenneth Manatt of Santa Barbara Research; Julia Torres and Jessica Soler of Glendale College; and Charles Taylor of Pomona College for NASA's Jet Propulsion Laboratory. urther information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Innovative Technology Assets Management
JPL
Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109-8099
E-mail: iaoffice@jpl.nasa.gov

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