

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

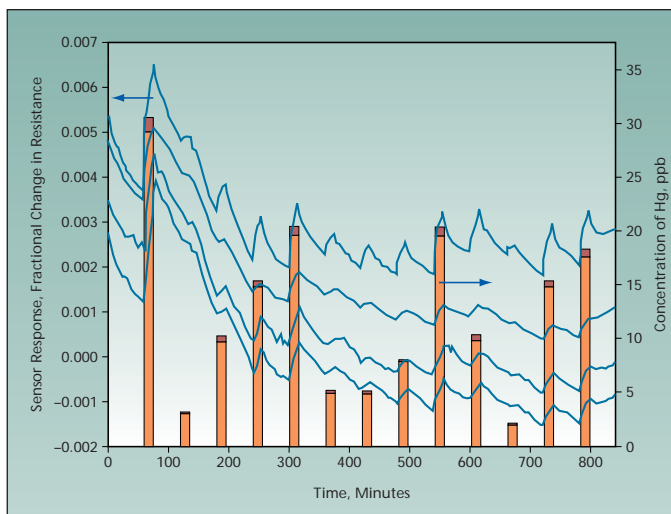
**Mercury has been detected at concentrations as low as 2 ppb.**

*NASA's Jet Propulsion Laboratory, Pasadena, California*

Like the palladium chloride ( $\text{PdCl}_2$ ) 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  $\text{PdCl}_2$  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



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.

of this and other experiments have been interpreted as signifying that sensors of this type can detect mercury at ppb con-

centrations in room-temperature air and can be regenerated by exposure to clean flowing air at temperatures <40 °C.

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 chlo-

ride 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