TEXAS INSTRUMENTS

Spreeta™

Gold Spreeta Surface Cleaning

Application Brief

Number 002

1999

Microcomponents Technology

SLYA018A

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Gold Spreeta™ Sensor Surface Cleaning

ABSTRACT

This process reviews the methods used to clean the sensitive gold surface of the Texas Instruments (TI™) Spreeta sensor, which is included in the *Spreeta Evaluation Kit* (formerly known as the *TISPR-1 Experimenter's Kit*†).

Introduction

Any gold surface that has been removed from its vacuum deposition chamber really cannot be considered clean, unless some effort has been made to clean it. This is due to the presence of atmospheric contaminants, including sulfur and other organic compounds.

The extreme sensitivity of the Spreeta sensor surface demands that all measurements be performed under conditions that closely control the binding of materials to and the removal of materials from the Spreeta sensor surface. It is critical to clean the Spreeta sensor surface to minimize signal interference because contaminants that can randomly attach to or come off of the Spreeta surface will interfere with the intended signal.

Solvent Spraying

A high-pressure solvent spray can be used to remove macroscopic amounts of surface contamination such as fingerprints. A convenient way to produce a solvent spray is to use an air brush available from most art supply stores. This treatment generally leaves the gold surface hydrophobic, presumably due to a small residual organic surface film.

Plasma Cleaning

An oxygen plasma can be used to remove organic thin films from the gold surface, including surface bound proteins from previous Spreeta experiments. The entire Spreeta sensor can be placed in the plasma chamber without electrical damage to the sensor. This generally leaves the surface hydrophilic, presumably due to the presence of a thin oxide film. This oxide can be removed by subsequent hydrogen plasma, a treatment that also leaves the gold surface hydrophilic.

† This test kit is being sold by Texas Instruments (TI) for experimental purposes only and not for commercial use.

Chromic Acid

Chromic acid can also be used to clean gold surfaces and leave them hydrophilic. Immerse only the sensing surface of the Spreeta sensor into a 20% solution of chromium trioxide in water.

NOTE: Do not immerse the entire Spreeta sensor.

CAUTION:

Take care when cleaning disposable gold films with this procedure. Prolonged exposure to chromic acid dissolves the chromium adhesion layer between the surface of the glass slide and the gold, resulting in delamination of the gold layer. TI recommends soaking disposable slides for no longer than two minutes.

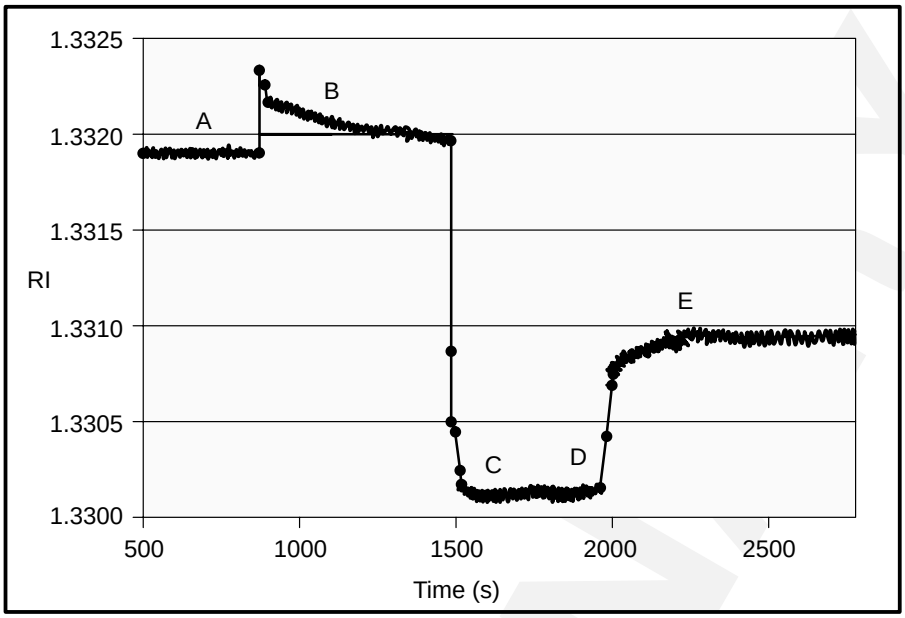
Detergent Scrubbing

If you are careful, you can clean the gold sensor surface by gentle rubbing with a cloth wet with an aqueous detergent solution, such as 4% sodium dodecyl sulfate (SDS). Eventually, the physical contact of this method does remove gold from the surface; but if you are careful, you can clean one gold surface dozens of times.

In Situ Cleaning Using NaOH/Triton X-100

Another method of reproducibly preparing a clean gold Spreeta surface involves exposure to a solution of 0.1 M NaOH and 1% Triton X-100. This method effectively removes small amounts of surface contamination, as illustrated in Figure 1, where A indicates a phosphate buffered saline (PBS) baseline when the surface is dirty, B indicates the addition of NaOH/Triton X-100 cleaning solution, C indicates the PBS baseline when the surface is clean, D indicates the binding of approximately one layer of bovine serum albumin (BSA), and E indicates a return to PBS.

NOTE: There is minimal dissociation of BSA after rinsing, and this indicates minimal residual surface contamination.



NOTE: A = The baseline with PBS running buffer
B = The application of 0.12 N NaOH/1% Triton X-100
C = The new baseline with PBS running buffer on the cleaned gold surface. The refractive index shift between A and C (approximately 2.0×10^{-3}) demonstrates how dirty the gold surface was prior to cleaning.
D = The binding of 100 ug/ml of bovine serum albumin (BSA) in PBS
E = The new PBS baseline after BSA has been irreversibly bound

Figure 1. Surface Cleaning

Summary

These procedures may be used singly or in combination to remove surface contamination in preparation for the binding of bio-molecules directly to the gold surface. They can also be used for the removal of bio-molecules and for regeneration of the sensor surface. More information on Spreeta is available at www.ti.com/spreeta. Send all questions and comments to spreeta@ti.com.

References

1. *Spreeta Evaluation Kit User's Guide*, Texas Instruments Incorporated, Dallas, September 1999.
2. Bain, C, and others, *Journal of the American Chemistry Society*, 111, 321–335, 1985.