National Aeronautics and Space Administration

Fabrication of Nanopipette Arrays for Biosensing

Nanotechnology focuses on the fabrication of resourceful materials at the nanoscale for application in nanodevices. One such device is a nanopipette biosensor which, through a “lock and key” approach, can distinguish between various bio-molecules in order to diagnose infectious diseases, cancer and environmental conditions. This technology can be expanded to an array for increased signal, signal redundancy, multiplexing for various biomarkers, and increased device yield.

Patent

This technology is protected by a pending U.S. Non-Provisional Patent Application. (Reference No. ARC-16456-1)

Electrical readout biosensors have gained much attention because, in principle, they can be made more compact than optical technologies. Advances in microfabrication and related technologies have been aiding the electrical readout based biosensor development to the forefront. This cutting edge invention from NASA permits a multiple channel array of nanopipettes to be fabricated, with some control over channel diameter, channel density, channel length, and other parameters of interest. Presently, the nanochannels must be formed one by one, or in batches with only a few channels per batch.

Benefits

- Multiple channel array
- Increased device yield
- Compact
- Sense presence of specified targets or component(s)

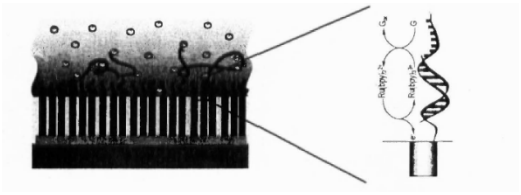
This invention is available for licensing from NASA’s space program to benefit U.S. industry.

Technology Details

This invention provides an array of nanopipette channels, formed and controlled in a metal-like material that supports anodization. The invention also permits selective first and second functionalizations, which may be the same or be different, of first and second channel surfaces so that different reactions of a multi-component fluid flowing in these channels can be evaluated simultaneously. The materials that support anodization include aluminum, magnesium, zinc, titanium, tantalum and niobium, referred to here as "AN-metals." The relevant, controllable anodization parameters include applied electrical potential, current density, electrolyte concentration, solution pH, solution temperature and anodization time. The channel parameters that can be controlled include pore diameter, pore density or spacing and maximum channel length of a pore. An anodization process is initially applied to provide a plurality of adjacent nanopipette channels having inner diameters in a selected range, such as 10-50 nanometers (nm). The nanopipette array can sense the presence of a specified component(s), by production of a characteristic signal associated with the functionalized site in the presence of the specified component. Differing concentrations of the same specified component can also be estimated and controlled.

Commercial Applications

- Biomedicine
- Biosensing
- Life detection
- Security
- Environmental sensing
- Diagnostics for selected infectious diseases
- Rapid response water quality monitoring
- Tracing chemicals in a sample fluid



An array of carbon nanofibers as nanoelectrodes

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