MODERN MICRO SENSOR ARRAYS FOR CHEMICAL ANALYSIS

Scientists engineer new materials and microsystems using fabrication processes from the integrated circuit (IC) industry. Micro-electro mechanical systems (MEMS) primarily use silicon because of its well understood oxide, doping, and etching properties. The fabrication method used to create integrated circuits now can also be applied to the world of chemical sensing as well.

This project developed a semiconductor micro sensor with the ability to sense changes in ionic concentration of solutions. These ionic changes will in turn change the output current of the sensor relating ion variations.

The basic sensor is designed around MOSFET (Metal Oxide Semiconductor Field Effect Transistor) technology. The figure below shows a cutaway of standard n-type MOSFET.

This n-MOSFET shown to left is an n-type device because the substrate experiences an increased concentration of electrons on the surface between the n-source and drain. This inversion charge is responsible for the current flowing in the device. What makes the ChemFET (Chemically Sensitive Field Effect Transistor) different from a MOSFET is the application of specific gate materials that will change the current characteristics when in the presence of particular ions.

To date the sensors drain currents have been modeled theoretically and the final processing steps are being completed. We believe the sensor will also require calibration with respect on chip reference electrode before absolute ion concentrations can be determined.

These micro sensors can also be adapted to measure many types of ions (Na+, K+ etc.). Not only can ions be measured but enzymes or proteins may also be detected with the implementation of other gate materials.