Micro-Sensor Array Platform

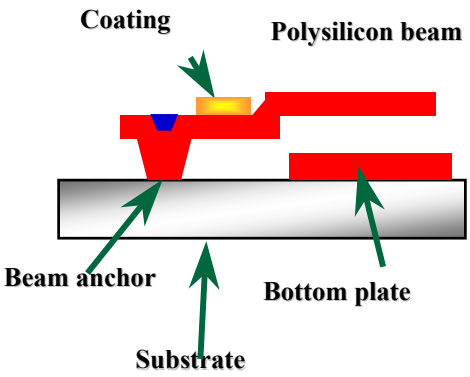
Low-cost, very low-power wireless sensor array platform

Low cost sensors are critical need and enabling technology in many sectors

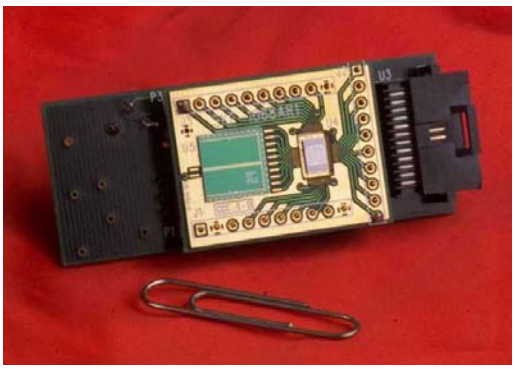
Numerous national studies and working groups have identified low-cost, very low-power sensors as a critical technology for increasing energy efficiency, reducing waste, optimizing processes, and enabling homeland security efforts. Sensor arrays that include wireless connections, signal processing, and self diagnostics and calibration will allow researchers to monitor processes more fully and increase knowledge gained in their research and end users to better measure, control, and optimize processes. Two major application areas would include buildings and factories that monitor for energy reduction, plant safety, waste minimimization, increased yield, and higher throughput. Better control of the indoor environment and improved personnel health will also be possible with low-cost sensing. Reducing the power requirements will allow batteries to power these arrays for years and make energy scavenging from the enviroment a real possibility for running the sensors. This would make the "peel, stick, and forget sensing" a realistic goal and especially attractive to homeland security needs.

Development of low-cost, very low-power, wireless micro-sensor array platform

The overall goal is to develop a micro-sensor array platform for measuring physical and chemical parameters. The array is based on patented work in microfabricated cantilever arrays. The cantilever operates by coating it with a material that selectively absorbs that chemical. In stress detection mode, the selectively-absorbing coating expands and bends the cantilever, while in mass mode, the mass of the absorb material reduces the resonant frequency of the cantilever. Cantilever transduction provides high sensitivity and economical microfabrication of arrays; advantages over other solid-state sensors. We have developed electrical readouts sensing the change in capacitance between the cantilever and a base plate. We have demonstrated sensitivities to 0.1 nanometer of movement and parts-per-billion concentration for some gases. Arrays with ten microcantilevers have been fabricated, and coatings have been developed for several gases including mercury and hydrogen. Ongoing development includes incorporating IR sensing for occupancy and motion detection as well as adding more gases to the measurement capabilities such as carbon dioxide, humidity, and carbon monoxide. Additional development in robust protocols for signal transmission over power lines is underway.



Microfabricated Cantilever



10-Cantilever Array with Readout Electronics
(Latest version needs less than one milliwatt.)

Features

- **MicroSensor Array – Tens of sensors on a single substrate**
- **Variety of sensors – gases, motion, temperature**
- **Very low power – 5mW in continuous, microwatts in pulsed mode for complete measurement system**
- **Wireless transmission or Transmission over existing infrastructure power wiring**
- **Low cost – $10s for an array system**

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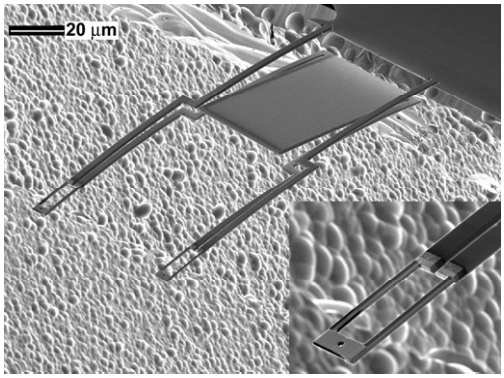

IR Sensitive MicroCantilever

Intelligent sensor platform

Multiple-sensor spread-spectrum telemetry architecture