Nanomechanics and Micromechanical Sensors

Zhiyu (Jerry) Hu Ph.D.
Oak Ridge National Laboratory, Oak Ridge, Tennessee

Micromechanical sensors such as microcantilever have demonstrated ultra-high sensitive as sensor platform for physical, chemical and biological detections in air and liquid. One instance, whereby selective molecular adsorption onto the cantilever surface alters the effective mass and/or stiffness of the cantilever—causing a shift in the cantilever's resonance frequency—has been demonstrated previously as a sensor for mercury vapor, relative humidity, ultraviolet radiation, magnetic susceptibility, and chemical reaction-induced weight loss of sub-nanogram quantities. Another instance, for non-labeling bio-detection when target bio-molecular adsorbs onto the surfaces of microcantilever biochemomechanical reaction in nanometer scale induces free surface energy change then transforms to the surface stresses and consequently leads to mechanical bending of structure. Newly developed optical and electrical array signal readout systems make microcantilever sensor as an idea platform for miniaturized, multi-target, gas/liquid dual environment biological and chemical detection.