

Micro-Preconcentrator for Integrated Preconcentration and Detection of Chemical Agents and Explosives

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This paper describes a mass-sensitive, microfabricated preconcentrator for use in chemical detection microsystems. The device combines mass sensing and preconcentration functions to create a novel smart preconcentrator (SPC) that helps a user determine when sufficient analyte has been collected for analysis by a downstream chemical detector. The combination of these functions allows dynamic variation of chemical detection microsystem cycle times in response to changing analyte concentrations.

The SPC is constructed using a SOI wafer, which allows precise definition of the device's thickness. A device takes the form of a clamped-clamped silicon bridge with thin-film metal lines that provide for device heating and excitation. Subsequent to MEMS microfabrication, the SPC is coated with an adsorbent layer to allow it to selectively collect chemical analytes. During operation, the device is excited into resonance using a Lorentz-Force actuation method, and the frequency of operation shifts in inverse proportion to the mass of collected analyte. Such frequency shifts can be measured by a back-EMF in the SPC's metal drive/transducer line. We will present on the device theory of operation, design variations, fabrication, coating, and vapor system testing.

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