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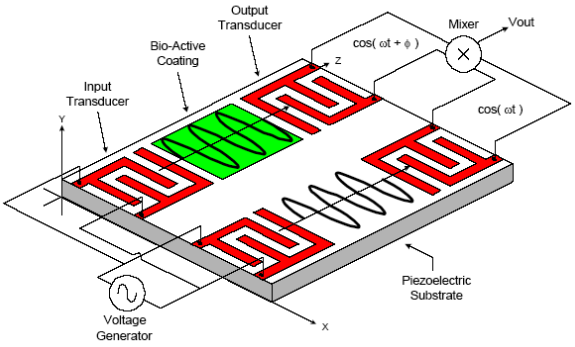
Acoustic Wave Biosensors

Sensitive and Selective Liquid-Phase Microsensors

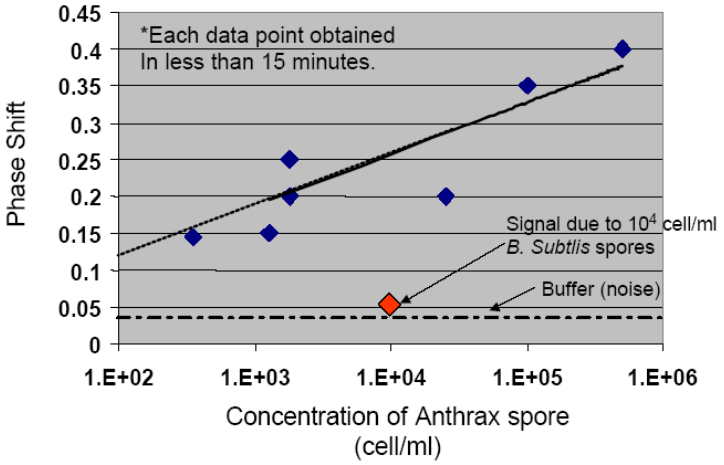
Overview



Surface acoustic wave (SAW) sensors have been routinely applied in the fields of chemical and biological sensing. Given that the acoustic energy is confined near a thin surface region of the substrate, SAWs are highly sensitive to surface perturbation of the propagating medium, allowing the surface wave device to operate as mass or viscosity sensor. For sensing in liquid environments, acoustic waves that have the particle displacement parallel to the device surface and normal to the wave propagation direction are essential. These waves, referred to as shear horizontal (SH) waves, will propagate without damping. The SH-SAW devices operate at frequencies from ~ 80 to 400 MHz and have a mass sensitivity proportional to the square of the frequency. For example, if the operating frequency was increased from 100 to 300 MHz, then the theoretical mass sensitivity will increase by a factor of nine. Our experimental results show that higher frequency devices (e.g. 325 MHz) can achieve detection limits below 1ng cm^{-2}. When used as an immunoassay, these devices can achieve excellent specificity and sensitivity in fluid detection applications and are ideal for antigens ranging from small proteins to bacterial spores.

Approach

Preliminary capture studies were done using the monoclonal antibody BD8 with a high degree of selectivity for anthrax spores. A monolayer of antibodies attached to the waveguiding layer was used to capture the non-pathogenic simulant B. thuringiensis B8 spores with a background of approximately 10,000 B. subtilis spores to determine non-specific binding. Detection limits of approximately 800 spores/ml were obtained. We have also demonstrated the ability to selectively bind and detect proteins and viral particles.



Please address comments or questions to BioNano@sandia.gov

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