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Dual Output Surface Acoustic Wave Sensors for Molecular Identification

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Surface acoustic wave (SAW) sensors can provide two sensor responses: changes in wave velocity and wave attenuation. With a polyimide-coated SAW device, the relative magnitude of these two responses depends on the molecular species being absorbed into the polyimide. Thus, when a single coated SAW sensor responds to an unknown molecular species, a comparison of the values of these two responses can be used to identify the molecule. With the molecule identified, the absolute value of either response can be used in conjunction with calibration curves to determine the gas phase concentration. These two independent responses could also be used to decrease the number of sensors required to evaluate mixtures.

1. Introduction

This paper describes a technique for determining both molecular identification and concentration of an isolated gaseous species based on the response of a single surface acoustic wave (SAW) device. The basis for the technique is to simultaneously monitor both the velocity and attenuation (i.e., the rate of decay) of the wave as it travels along the substrate and interacts with a thin film (e.g., a polymer) formed on the device surface. Typical SAW chemical sensors are used in an oscillator loop which utilizes only the velocity response;[1] molecular discrimination is achieved using an array of sensors containing several chemically selective coatings with pattern recognition schemes being used to interpret the responses.[1,2]