CHEMICAL AND ENVIRONMENTAL TRANSDUCERS

In chemical SAW transducers, the pairs of IDTs are formed on the same side of the substrate as shown in Fig. contrast to the physical SAW transducers described earlier.

In the intervening space L of the sensing oscillator, a (bio) chemical interface layer is deposited. The second oscillator serves as a reference. Mass loading caused by the interface layer will change the sensing oscillator frequency.

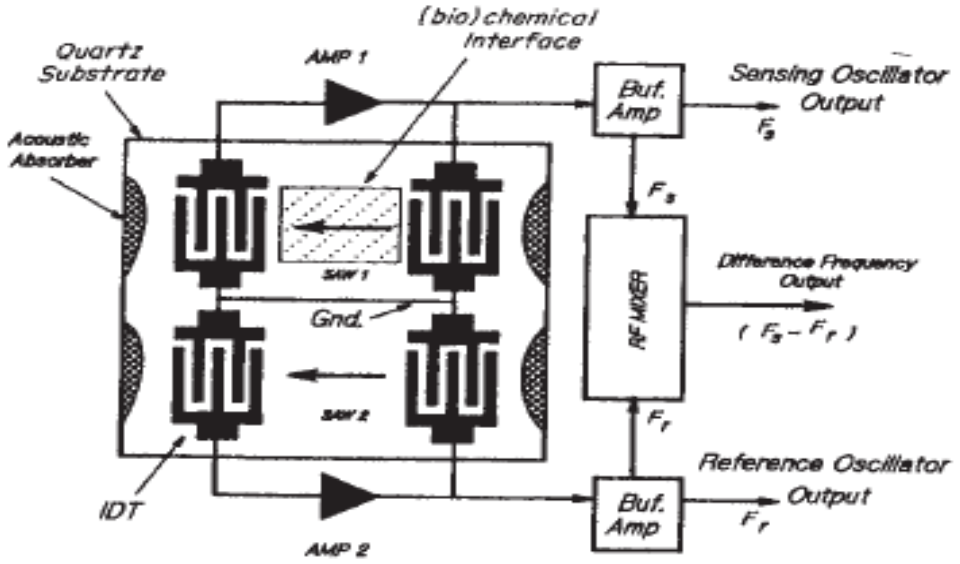

Figure 5.28 Dual SAW oscillator used as a chemical transducer.

Temperature and stress affect both oscillators equally, and they represent common mode signals. The difference in frequency (Fs-FR) will then be proportional to the magnitude of the measurand, to the extent that it perturbs the interface layer. The transduction mechanisms are otherwise identical to those described for physical transducers. The magnitude of the change in frequency caused by mass loading of a polymeric interface layer is given by

$$\Delta f = (K_1 + K_2) f_0^2 (h\rho) \qquad (5.23)$$

where K_1 and K_2 are material constants of the piezoelectric substrate. h is the thickness, and ρ is the density of the interface layer. The product $h\rho$ is the mass per unit area of the interface layer.

In chemical, environmental, and biochemical transducers, the changes in the frequency Fs are primarily brought about by the mass loading effect of the interface layer. A biochemical transducer uses the selectivity of enzymes and antibodies to mass load the layer, whereas a chemical sensor depends on the adsorption and chemisorption of the analyte gases.

These changes alter the SAW velocity. The transduction takes place when the velocity changes cause changes in the total electrical phase shift _T around the oscillator loop and corresponding changes in the oscillator frequency proportional to the mass loading of the interface layer.

In addition to frequency changes caused by the interface layer, the SAW attenuates as it propagates between the IDTs. Viscoelastic polymer interface layers, on absorption of volatile organic species, become soft because of plasticity effects and the SAW propagation losses increase because of softening of the polymer. The attenuation of the SAW represents yet another transduction mechanism in a chemical sensor which has been used to identify several chemical species for a particular chemical environment.

Source: http://mediatoget.blogspot.in/2012/07/chemical-and-environmental-transducers.html