An experimental study of gravimetric Love-wave acoustic sensors incorporating SU8-2000 guiding layers

J.M. Fougnion1,*, L. Rousseau**, N. Fourati*, M. Bonnefoy* and G. Lissorgues***

Introduction

The Love wave sensors offer a high potential for biological applications since they are very sensitive to their environments. They comprise a waveguide geometry where a shear-operating surface acoustic wave (SAW) device is coated with a layer of a dielectric material. The effect of this overlayer is to trap the acoustic energy near the sensing surface, reducing propagation velocity and increasing the sensitivity to surface perturbations.

Devices and preliminary results

SAW sensors are fabricated with 30 pairs of 80 nm aluminium thick finger IDTs having a period of 10 µm, which corresponds to an operating frequency around 420 MHz and to an acoustic wavelength of about 10 µm. The IDTs aperture was 2 mm and the IDT centre-to-centre separation was 4.3 mm. A systematic experimental trial has been performed to measure the electrical parameters of the SAWs after each new technological step.

Process SAW – SU8-2000

1. Al deposition - 1µm electrical pads - 80 nm IDTs
2. deposition of SU8-2000 wave guiding layer
3. SU8-2000 development
4. Cross-section of the sensor with flow through cell

Inductively coupled - two-port-device

Electrically connected - two-port-device

the shape of the curves shows the transfer characteristics of delay lines

the oscillations are due to crosstalk ➔ the level of this crosstalk must be reduced

strong damping of the signal is observed for coated devices ➔ acoustic loss at the operating frequency.

Conclusions

We have developed two electrical SH-SAW devices for liquid environments. In both cases we observe the same general shape for the direct frequency response of uncoated and coated SAWs. The signal improvement by using matching and shielding is in progress. The last step after gold layer deposition is to test mass sensitivity by using well defined biological molecules.

References

* D. W. Branch and S. M. Brozik, Low level detection of a Bacillus anthracis stimulant using Love wave biosensors on 36°YX LiTaO3 substrate operating at 420 MHz were coated with a SU8-2009 photosensitive polymer. In this work we study two kinds of two-port devices: inductively coupled and electrically connected. We measured the S-parameters in a reflection (S11 and S22) and transmission (S12 and S21) configuration in order to know the influence of the SU8-2000 layer deposition.


** Jeune Equipe 2405, SMM, Groupe ESIEE, Cité Descartes, BP99, 91620 Noisy-le-Grand cedex, France.
*** Groupe ESIEE, Cité Descartes, BP99, 91620 Noisy-le-Grand cedex, France.