Thesis proposal

N° :

MEMS packaging: vacuum and residual gas analysis in cavities

MEMS (MicroElectroMechanical Systems) are more and more used in a wide range of applications. Already available in automotive or industrial applications, they enter new markets in consumer applications. One example is the introduction of accelerometers and gyroscopes in video game consoles or cell phones. However, the existing packaging technologies are not entirely satisfactory, in particular for MEMS requiring vacuum operation.

New encapsulation technologies for MEMS are developed at CEA-LETI MINATEC. Developed at wafer level, they allow creating a cavity around the MEMS defined by an individual cap. For devices that need to operate in vacuum, two conditions must be fulfilled by the encapsulation method. First, low pressure must be obtained when the cavities are closed. Then, it must be kept low during the whole life of the device. So, the packaging technology must be hermetic and a getter material is often introduced in the cavities to compensate degassing or leak rate.

Today, the pressure obtained in cavities closed by some of encapsulation techniques is not low enough. The aim of the PhD work is the analysis of pressure and type of gas in the cavities to improve the sealing technologies and insure the operation of devices for a long time.

The candidate will use resonant MEMS whose electrical performance varies with pressure. He will also contribute to the evolution of a test bench under high vacuum with a high resolution spectrometer to analyse the cavity atmosphere. He will pursue the following goals:

- knowledge of the sealing methods
- development of methodologies for quantitative and qualitative analysis of vacuum and gas species in the cavities
- evaluation of the limits of the characterization methods
- correlation between experimental results with the resonant characteristics of devices and process parameters
- evolution of characterization methods from the obtained results

From all the results, the PhD student will propose improvements for sealing technologies and fabrication of MEMS for a better control of pressure in the MEMS cavities.

Laboratory

DRT/DIHS/LTPI-LCFM
CEA/GRENOBLE 17 rue des Martyrs38054 Grenoble CEDEX 9

Contact

Gillot Charlotte phone: 33 4 38 78 42 45 email: charlotte.gillot@cea.fr
Nicolas Pierre phone: 33 4 38 78 55 96 email: pierre.nicolas@cea.fr