Multifunctional wafers integrating monolithic architectures reconstructed from CMOS chips and magnetic sensor chips

Proposers

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Developments in the nanotechnology area evolved in recent years in order to be able to integrate more sensors together with electronic control and acquisition. Only in this way can low power portable systems be achieved. Several systems integrating chips with magnetoresistive, optics or MEMS elements have been successfully integrated with discrete electronic modules. However, when it is necessary to acquire signals of various sensors in arrays, it becomes impossible to use a wire contact scheme (wirebonding) to address each of the external modules.

Currently CMOS chips with electronic control and multiplexing (sizes about 1-3 mm^2) are manually embedded in machined cavities Si wafers by reactive etching processes. This process allows using chips with 1-3 mm^2 from high cost CMOS wafers and continue the front-end process integration at wafer level. This monolithic process has been used for microfabrication of magnetoresistive sensors on CMOS. However, it is not compatible with integration into biochips that require microfluidics, for example, because the areas of the channels occupy dimensions ranging from several mm to cm, is uneconomical to develop them over a CMOS area, given its high cost.

In this work, the student will use microfabrication techniques to make the connection between two chips previously processed, one based on CMOS wafers embedded in cavities with one level contacts. The student will develop a pick-and-place system to place the CMOS chips in the wells with controlled alignment and precision better than 2 micrometers.

The impact of this thesis will allow providing a CMOS chip integration service for multidisciplinary projects without resorting to wirebonding between chips, making it compatible with 3D packaging architectures and microfluidics.

Profile sought: preference, but not limited, to students with a background in Physics and Electrical Engineering with an interest in Devices, and Micro and Nanofabrication.