

# RELIABILITY OF POLYSILICON MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)

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*Abstract. Micro Electro Mechanical Systems (MEMS) are devices in which electronics and mechanics are coupled in order to obtain highly sophisticated systems able to act as sensors and/or actuators. The design and production of MEMS had an enormous increase in the last decade. Due to the diffusion of their use in practical applications, the problem of MEMS reliability is becoming increasingly important. The end user wants to know with sufficient precision the life duration of each MEMS, hence it is of paramount importance to be able to characterise the main mechanical properties of materials at the scale of micron. Polysilicon is one of the most used materials for the construction of MEMS. Its typically brittle behaviour deserve particular attention due to size effects which can characterize its resistance and fracture properties. Many different test systems have been designed in order to be able to determine the main mechanical properties of polysilicon at the scale of micron; these can be divided in two main categories: out of chip and on-chip. The first class concerns the determination of mechanical properties by means of laboratory tests in which a small specimen of polysilicon is tested after having been cut from the wafer. The second class concerns tests performed directly on-chip inside MEMS which are designed specifically for the testing procedure. The lecture will focus on the general problem of MEMS reliability with special attention to polysilicon MEMS. Various test procedures will be compared and the experience of the Author on the design and mechanical characterisation of polysilicon by means of on-chip tests will be discussed.*

*Keywords. MEMS, polysilicon, reliability, on-chip tests, mechanical properties*