# Thin-film silicon MEMS

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An overview of our work on microelectromechanical (MEMS) devices based on low-temperature thin film silicon as a structural material is presented. The talk will discuss aspects related to the fabrication, electromechanical characterization, and applications of thin film silicon MEMS.

The fabrication of thin film silicon MEMS is made using surface micromachining techniques. The use of low-temperature fabrication processes allows the fabrication of MEMS microbridge resonators on glass and on plastic (PET) substrates. The use of different sacrificial layers (photoresist or aluminum) allows the use of thin-film structural layers deposited at temperatures between room-temperature and 350 ºC.

The electromechanical characterization of the thin film MEMS devices emphasizes the characterization of their behavior as microresonators. The quality factor and the dissipation mechanisms in electrostatically-actuated microresonators based on these materials are studied from the point of view of materials properties and microstructure design. Designs allowing different vibrational modes such as flexural and torsional are developed to achieve high-Q resonators. The deflection of the structure in vacuum, air and water are discussed. The detection of the mechanical motion of the devices is mainly achieved by optical addressing. Sensitive detection of the mechanical motion using integrated magnetic sensors will be presented.

Applications of thin film MEMS devices as micromechanical sensors for environmental, chemical and biological detection will be discussed. Strategies for device functionalization and sensitivities to the attachment of biomolecules such as DNA and proteins will be presented. Limitations and challenges, as well as, other applications, such as passive 3D structures and actuators will be presented.

Keywords: thin-film silicon, MEMS

**Topic**: Nanometer structures, nanotechnology