**Introduction**

Just like IC technology 30 years ago, MEMS technology is still in its juvenile age. Most of the MEMS products are still prototypes. During the past few years, radio-frequency micro-electro-mechanical systems (RF-MEMS) fabricated using semiconductor micro-fabrication technology have gained significant interest for wireless communication applications owing to their small size, integration capability and superior performance. Tunable capacitors could find applications to impedance matching networks, replacing switched capacitors or could enable tunable voltage controlled oscillators. The advantages of MEMS devices is a high linearity compared to semiconductor varactors [1].

Micro-electro-mechanical systems (MEMS) technology is one of the most exciting areas in the field of “analog” technology. Sensitive, compact and inexpensive inertial sensors based on MEMS technology allow system designers to add new capabilities to their products that make them easier to use, more functional and more reliable [2]. WTC has asked the major industrial companies involved in RF-MEMS developments for cell phones and WLAN for commercialization. Asian manufacturers like LG and Samsung are taking interest in this field [3].

The main market is BAW filters in cell phones. BAW resonators of Infinon and Agilent have been already implemented in mobile phones. After that switches and micro-mechanical resonators are contributing to the growth of the RF-MEMS market. RF-MEMS are one of the new major markets. WTC expected the market of RF-MEMS in the range of US$ 700 to 1000 million in near future [4] [5].

MEMS components are characterized by their small size (characteristic dimensions typically between 1 μm and 1 mm), low cost, low power consumption, reliability, and
integrity with electronics. Typical MEMS products are mechanical actuators, sensors and other devices, which are microscopic in scale and are fabricated by integrated circuit technology. The operation principle of these components can be based on various physical phenomena, such as mechanical or thermal properties of micro machined structures, and the components often include integrated microelectronic circuitry [6].

Reliability is of concern if MEMS machinery is used in critical applications. MEM is usually a combination of circuits and micro-machinery. The reliability aspect includes both the electronic and the mechanical parts, complicated by the interactions. The effects of atomic forces and surface science dominate in the micro-scale. Many academic and government laboratories and companies have started to report cycling lifetimes for fabricated prototypes. Over 100 billion cycles for ohmic contact switches have been reported by technologies like Radant [7].

Reliability classes of RF MEMS devices can be done according to the level of mechanical complexity and boundary conditions. The first class of reliability comprises all passive lumped or distributed components that are designed through micromachining fabrication. The second class of devices require some mechanical moment during functioning. The third reliability class includes all devices that need two normally separate mechanical parts to reach and maintain contact during operation cycle [8].

Material technology is being revolutionized and recharged. Silicon is the most widely used material for manufacturing MEMS due to its ready and economic availability with excellent and well-defined mechanical and electrical properties. Poly-silicon is used in both mechanical and electronic parts in MEMS devices. Silicon oxide is used as the sacrificial layer material in the surface micromachining process as it is prone to etching with hydrogen fluoride whereas silicon is resistant to etching. Silicon nitride is used as masking material for alkaline etch solutions and insulating thin film. Silicon nitride is also used to make MEMS membranes, plates and cantilevers. Silicon carbide offers hardness and resistance to harsh environments and high temperatures. Research in new materials for MEMS is also going on [9].
Micro-Electro-Mechanical Systems (MEMS) are integrated micro devices or systems combining electrical and mechanical components that can sense, control, and actuate on the micro scale and function individually or in arrays to generate effects on the macro scale. MEM is the most promising area in future computer and machinery, the next logical step in the silicon revolution. Fabricated using Integrated Circuit (IC) compatible batch-processing techniques, the small size of MEMS opens a new line of exciting applications, including aerospace, automotive, medical, fluidics, military, optics, wireless communication technology, space, satellite, medical technologies, environmental control, and many other areas [10].

Common processing techniques that are used to sculpt mechanical structures include bulk micromachining, wafer-to-wafer bonding, surface micromachining, and high-aspect ratio micromachining. Bulk micromachining includes etching procedures that selectively remove material; typically with a chemical enchant whose etching properties are dependent on the crystallographic, structure of the bulk material. Wafer-to-wafer bonding is a strategy commonly employed to get around the restrictions in the type of structures that can be fabricated using bulk micromachining. Because anisotropic etching, by definition only removes material, bonding of wafers allows for the addition of material to the bulk micromachining repertoire. High-aspect ratio micromachining (LIGA) is a newer technique, allow the fabrication of thick (usually >100 microns and up to centimeters thick), precision, high-aspect ratio MEMS structures (structures with near vertical sides) [11] [12].

In surface micromachining (SMM), alternating layers of structural (Poly-silicon) and sacrificial material (like silicon dioxide) are deposited and etched to form the shape required. Surface micromachining enables the fabrication of free-form, complex and multi-fabricate devices and systems without constraints on materials, geometry, assembly and inter-connections that is the source for the richness and depth of MEMS applications [13].