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Perspective

Note on Micro Electro Mechanical Systems

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DESCRIPTION

A small machine with both mechanical and electrical components is known as MEMS (Micro Electro Mechanical System). MEMS physical dimensions can range from several millimetres to less than one micrometre, which is a fraction of the width of a human hair.

MEMS are classified because the structures seen in conventional equipment, such as springs, channels, holes, and membranes. Some MEMS devices are referred to as transducers because they translate a measured mechanical signal into an electrical or optical signal. Micro machines are more frequently known as MEMS in Japan, while Micro Systems Technology (MST) is more commonly known in Europe.

Micro sensors, microprocessors, micro actuators, data processing units, and parts that can interact with external components make up MEMS. Unlike traditional mechatronic devices, MEMS are frequently produced using the same batch fabrication procedures as Integrated Circuits (ICs), and many commercial MEMS products are integrated and packaged alongside ICs. Micro-sensors that collect data and micro-actuators that turn energy into motion can both be integrated on the same substrate thanks to MEMS fabrication.

Micro sensors have since been employed for a wide range of sensor types, including temperature, pressure, magnetic fields, and radiation sensors. When compared to larger competitors, MEMS sensors were often far more efficient in terms of performance. Most individual's today contact with MEMS on a daily basis. MEMS are vital components in numerous statutory safety systems, like as airbags, Electronic Stability Control (ESC), and tyre pressure monitoring systems, and are found in at least 50 new cars that roll off the production line. Despite the low per-device production cost of MEMS, packing can be difficult. Each MEMS must be packaged to keep electrical and optical circuitry, as well as other device components, free of air and water contamination while yet interacting with the environment and accommodating motion.

Many individuals interact with MEMS every day, such as the little system on a chip (SOC) that automatically adjusts screen orientation on a smartphone. MEMS are projected to play a key role in the wireless Internet of Things (IoT) and home automation as they become smaller, need less power, and are less expensive to manufacture.

Materials for MEMS manufacturing

Silicon

Silicon is the material used to create most integrated circuits used in consumer electronics in the modern industry. The economies of scale, ready availability of inexpensive high-quality materials, and ability to incorporate electronic functionality make silicon attractive for a wide variety of MEMS applications. Silicon also has significant advantages engendered through its material properties. Silicon nanowires, fabricated through the thermal oxidation of silicon, are of further interest in electrochemical conversion and storage, including nanowire batteries and photovoltaic systems.

Polymers

Even though the electronics industry provides an economy of scale for the silicon industry, crystalline silicon is still a complex and relatively expensive material to produce. Polymers on the other hand can be produced in huge volumes, with a great variety of material characteristics. MEMS devices can be made from polymers by processes such as embossing or stereo lithography and are especially well suited to microfluidic applications such as disposable blood testing cartridges.

Metals

Metals can also be used to create MEMS elements. While metals do not have some of the advantages displayed by silicon in terms of mechanical properties, when used within their limitations, metals can exhibit very high degrees of reliability. Metals can be deposited by electroplating, evaporation, and sputtering processes. Commonly used metals include gold, nickel, aluminium, copper, chromium, titanium, tungsten, platinum,

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and silver. Other MEMS-related commercial applications include:

- Building management systems with sensor-driven heating and cooling systems.
- High-definition projection systems with micro-mirror arrays
- Smart dust for detecting environmental changes in clean rooms for molecular manufacturing (nanotechnology).
- Inkjet printers use micro nozzles to control the flow of ink.
- Microphones, barometers, accelerometers, and gyroscopes to support mobile apps
- Disposable pressure sensors for medical applications.
- Optical switching devices, which enable one optical signal to control another.