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Thin Film Deposition - Sputtering

Sputtering is a technique used for the deposition of thin films, a fundamental building block of MEMS-based products.

When combined with other MEMS-based processing techniques thin films can be used to fabricate components in applications ranging from telecom optical switch devices to automotive pressure sensors. They can be used as structural or sacrificial layers, and the films can be selectively etched in order to make a three-dimensional device. Sputtering is one of many methods to create thin films but is one of the most commonly used at Micralyne.

Sputtering involves striking plasma with a "target" material; this plasma erodes the target, ejecting target material onto the substrate upon which the film growth is desired. The target materials available at Micralyne include gold, platinum, silver, aluminum (and alloys), titanium, tungsten (and alloys), tantalum, chromium, and nickel alloys to name a few. Depending on the material selected, thin film layers can range from 5 nanometers for adhesion layers to microns for conduction layers.

An advantage of sputtering is its many parameters that can be used to influence the film characteristics. These characteristics include the stress, density, surface roughness and the strength of adhesion.

One of the key issues to consider when undertaking a sputtering run is cleanliness of the substrate before deposition occurs. Some forms of contamination are not easily detectable before deposition and small contamination seeds are magnified, forming larger artifacts. This is largely due to self-shadowing that occurs during the film growth. Trace amounts of chemical or moisture can affect initial film growth and therefore subsequent film performance. Similarly, the substrate's temperature and topography is critical.

By varying plasma pressure, the stress of the film can be changed. It is difficult to have a stress free film, as there is a sudden transition between tensile and compressive stress, which can lead to unpredictable results. Typically stable films of counteracting stress can be deposited in sequence to make a stable stress free film.

Often with MEMS, not all desired properties of a film can be attained. For example, a dense film is required to be a stable barrier, but is usually stressed compressively and may excessively deform final structures. Conversely, the most stable film may not produce a smooth and reflective surface, so tradeoffs are required when making mirror coatings. Due to the ability of target manufacturers to make a variety of alloys, it is possible to create structural films of high density and stability without complications of using stress balanced multi-layer films.

Micralyne's expertise in **metal deposition** expands over 20+ years. **Capabilities** include 3-target sputtering and 6-pocket evaporation for PVD coatings, PECVD dielectrics and plated AuSn solder. Micralyne has the ability to work with a variety of substrate materials including silicon, SOI (Silicon On Insulator), ceramics and glass.

In summary, high quality films to be used for structural, barrier, wear resistance, reflectivity, conductivity, and solder ability purposes can be deposited using sputtering techniques for a variety of MEMS applications.

Please **contact us** if you would like to learn more about thin film deposition capabilities at Micralyne and how they can be applied to your product.

- Glen Fitzpatrick, Chief Scientist -