

Ion Beam Milling for MEMs Applications

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Abstract

Selective removal of material is one of the oldest methods for micromachining MEMS components, Microwave Circuits and Photonics devices. While other methods for producing these devices exist, nothing is as good as selective removal when larger quantities of parts are required. There are two primary methods of selective removal; chemical and physical.

Chemical removal (better known as etching) is a fairly old and well understood process. Materials to be etched are coated with a protective mask layer and then subjected to chemicals that etch away the undesired material. A chemical etching program is cheap and easy to set up and works well for devices with gross features. It begins to exhibit problems however when features become finer and line spacing decreases.

Ion Beam Etching is a physical process of selective removal that initially follows a similar path as Chemical Etching, but produces a better result. An anisotropic process that can produce straight sidewalls in the etched patterns and faithful reproductions of designs, it is the preferred choice for engineers whether they are manufacturing MEMS devices with line resolutions on the nanometer scale RF designers creating complex filter and coupler arrays.

This presentation will discuss the results of a recent experiment designed to quantify the actual performance differences between etch methods. A review of visual evidence will be followed by a discussion of the experimental process including the design, manufacture, and testing of sample filters using both etch methods. It will also include feedback from a customer who performed their own head to head tests comparing ion beam etching with chemical etching. The results are nothing short of extraordinary. While the actual test itself used an RF filter to demonstrate the performance differences, the application of the lessons learned to other industries such as the MEMS community will be discussed.

This presentation will also address the myth that today's Ion Beam etch process is more expensive than chemical etching. Engineers who choose Ion Beam Etching will often achieve higher quality, greater consistency and a lower cost over the inferior chemical etch process.