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Wet Chemical Processing

Wet chemical processing at Micralyne encompasses both surface cleaning and material etching. The purpose of chemical cleans is to remove surface residues or particulate and etching is used to remove controlled amounts of specific materials. To achieve the required outcomes a wide range of chemicals are required including:

- Acids: Sulfuric acid, Phosphoric acid, Hydrofluoric acid, Nitric acid
- Bases: Ammonium Hydroxide, Potassium Hydroxide
- Oxidizers: Hydrogen Peroxide
- Solvents: Isopropyl Alcohol, Methanol
- Surfactants: Proprietary

The main challenges in wet chemical processing are reducing process variations and finding solutions to meet increasingly narrow product tolerances. With a talented team of engineers and process technicians who create innovative but robust methods of manufacturing a wide variety of parts, Micralyne is developing excellent solutions for difficult product requirements. High volume manufacturing of MEMS devices is still a relatively new industry. Micralyne's ability to customize processes to produce complex devices in high volume is what sets it apart from other companies.

At Micralyne, both TMAH and KOH are frequently used in silicon anisotropic etch. Below is a comparison explaining the different properties of each chemical.

- TMAH has better selectivity to oxide. Therefore oxide is used as an etching mask for TMAH whereas KOH needs nitride as a mask
- KOH has better selectivity to crystal planes so it is often used for deep structure etches
- TMAH gives more undercut and is usually used for suspending release structure (etching underneath)
- KOH contains K⁺ ion, which significantly degrades the semiconductor property. K⁺ contamination is a big issue for semiconductor devices
- KOH is cheaper than TMAH (often being 80% less)
- However, TMAH is safer than KOH, which is also important to consider

On a more general level, when comparing to other etching techniques, wet chemical processing offers a variety of benefits such as:

- Relatively low cost of equipment and overall product cost, due to the use of

chemicals and relatively inexpensive wet decks

- Increased throughput and cycle time when processing batches of wafers at the same time
- High material selectivity (ability to etch one material while not etching other materials)
- Ability to handle significant amounts of over etch due to high material selectivity, providing a robust process for removing material from a surface
- Less susceptible to pattern defects in the nanometer range
- High cleaning efficiencies when combining both chemical and mechanical methods of removal

Trying to get a process to meet design requirements is much more difficult than designing a part to fit already established process capabilities. It is very important to consider how easily a process can be ramped up in volume during the initial stages of product development. A strong focus must also be made on characterizing outputs of processes such as CDs (critical dimensions), depths, etc. Once these variations are known they can be used to finalize the design and mutually agree on specifications with the customer. A lot of upfront work during development can save huge amounts of resources in the future.

Please **contact us** if you would like to learn more about the wet chemical processing capabilities at Micralyne and how they can be applied to your product.

- Thomas Krywko, Process Engineer -