

Nano-master Megasonic Cleaning Patented Technology

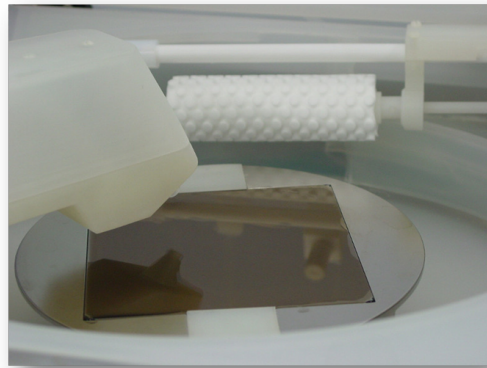
Megasonic cleaning is critical in semiconductor manufacturing because it enables **non-destructive removal of submicron and nanoscale contaminants** from delicate wafer surfaces and structures. As device geometries shrink below 10 nm, even particles smaller than 100 nm can cause defects, yield loss, or reliability issues. Traditional physical or chemical cleaning methods can either be **ineffective at these scales** or **damage fine features**.

Megasonic cleaning uses **high-frequency acoustic waves (typically 1–3 MHz)** to generate microscopic kinetic motion without cavitation bubbles in a liquid medium which can damage delicate artifacts.

Key advantages:

- Particle removal down to sub-50 nm
- Gentle on fragile features like high-aspect-ratio structures or low-k dielectrics
- Reduces chemical usage and environmental impact
- Supports high wafer cleanliness essential for critical processes like gate oxide formation, photolithography, and metallization

Nano-master has a patented technology for single-wafer megasonic cleaning, addressing the need for efficient removal of contaminants from semiconductor wafers **or masks** during manufacturing by delivering the megasonic energy through a DIW column in such a way that everywhere on the surface energy density is constant i.e. if there is no damage in one place there won't be elsewhere either. The innovation lies in the integration of megasonic energy with precise fluid dynamics and the move of the nozzle in a nonlinear manner as the substrate rotates to enhance cleaning efficacy by delivering maximum power while minimizing potential damage to delicate wafer structures.



Key components and functionality

- **Megasonic transducer:** Generates high-frequency acoustic waves (typically in the megahertz range) to produce cavitation in the cleaning fluid, facilitating the dislodgment of particles from the wafer surface.
- **Wafer support mechanism:** Securely holds the wafer in place, ensuring uniform exposure to the megasonic energy and cleaning fluids.
- **Fluid delivery system:** Introduces cleaning solutions onto the wafer surface in a controlled manner, often employing a nozzle or spray mechanism to ensure even distribution.
- **Drainage and recirculation:** Efficiently removes used cleaning fluids and contaminants from the cleaning chamber, allowing for recirculation or disposal as appropriate.

Advantages

- **Enhanced cleaning efficiency:** The combination of megasonic energy with targeted fluid delivery improves the removal of submicron particles and residues from wafer surfaces.
- **Reduced chemical usage:** By leveraging physical cleaning mechanisms, the system can decrease reliance on aggressive chemical agents, promoting a more environmentally friendly process.
- **Minimized wafer damage:** The design ensures that the acoustic energy is uniformly distributed, reducing the risk of localized damage or erosion to sensitive wafer features.
- **Scalability:** The apparatus is adaptable to various wafer sizes and can be integrated into existing semiconductor fabrication lines.