

Oxide Growth Rate Up to 30% Faster

Wafer-to-wafer and across-wafer uniformity improved with the RASIRC Steamer

Recent test results delivered up to 30% improvement in oxide growth rate for thin films and over 6% for very thick oxides when replacing bubblers or direct liquid water injection with the **RASIRC Steamer** Steam Generation System. Operating costs were reduced significantly by eliminating carrier gases and oxygen or hydrogen for pyrolytic generation.

Users of the **RASIRC Steamer** demonstrated increased growth rate and uniformity by being able to fully saturate the furnace tube with 100% pure water vapor at flow rates not normally available from alternative techniques. Results reached maximum theoretical growth rate.

Throughput

- Increases throughput by delivering high quantities of pure steam
- 100% UHP Steam eliminates oxygen and hydrogen, so there is no interference with steam diffusion into the silicon oxide and theoretical maximum growth rate is achieved
- Eliminates thermal shadow introduced when using a torch, so the entire furnace tube can be used for thermal oxidation
- Runs process recipes with multiple flow set points High and Low

Cost Reduction

- Eliminates hydrogen/oxygen costs
- Delivers bottom line savings via increased throughput and process uniformity
- Eliminates chillers and spares for torches

Contamination Control

- Equals or exceeds the purity of pyrolytic steam by enabling the use of water vapor from purified steam
- Eliminates the torch and the particles it generates
- Prevents particles from passing through with the steam by employing a nonporous membrane
- Eliminates metal components and catalysts, ensuring metallic free steam

Repeatability

- Improves front to back uniformity by eliminating thermal shadow from the torch
- Ensures furnace saturation by delivering high quantities of steam (greater than possible with a torch)
- Maintains 100% partial pressure of water vapor resulting in better chamber uniformity
- Purifies steam instead of DI water, yielding ultra high purity and consistency

Safety

- Eliminates explosive hydrogen and oxygen
- Eliminates high temperature external torch
- Operates at a safe temperature, significantly lower than torches

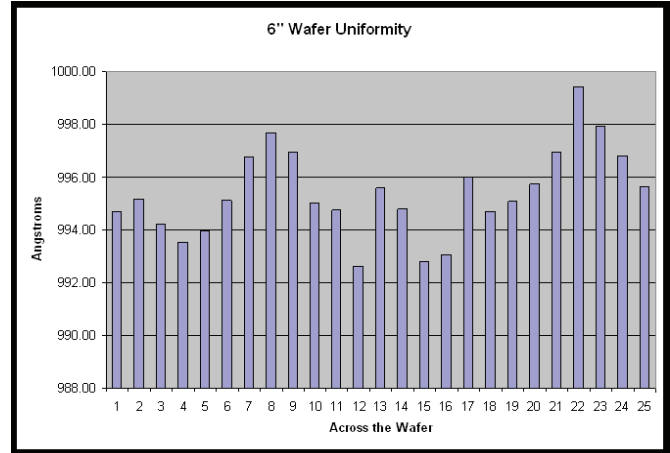


Figure 2: Tests of wafer uniformity on 1000 Angstrom film show less than 1% variation across 25 points when the RASIRC Steamer is the source of ultrapure steam.

About RASIRC and RASIRC Steamer

The **RASIRC Steamer** uses a non-porous hydrophilic membrane that selectively allows water vapor to pass. Selectivity is significant with up to 1,000,000x relative to nitrogen molecules. In the vapor phase, the membrane only allows water through. All other molecules are greatly restricted, so contaminants in water such as dissolved gases, ions, TOCs, particles, viruses, bacteria, pyrons, and metals can be removed from the steam phase.

RASIRC develops products that purify and deliver ultra pure liquids and gases, with a primary focus on water vapor. While steam is used extensively in the semiconductor industry, RASIRC technology is the first to purify live steam to generate ultra high purity (UHP) steam. Starting with de-ionized water and using specialized membranes to reduce total metals to less than 10 parts per trillion, this technology reduces cost, improves yield, and dramatically improves safety. The UHP steam generated by RASIRC products is of critical importance for many applications in the semiconductor, pharmaceutical, medical, biological, fuel cell, and power industries.



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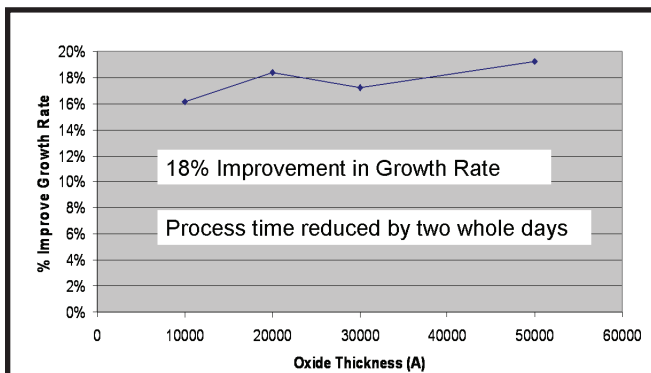


Figure 1: Tests comparing bubbler performance versus the RASIRC Steamer show continuously faster growth rate exceeding 16%.