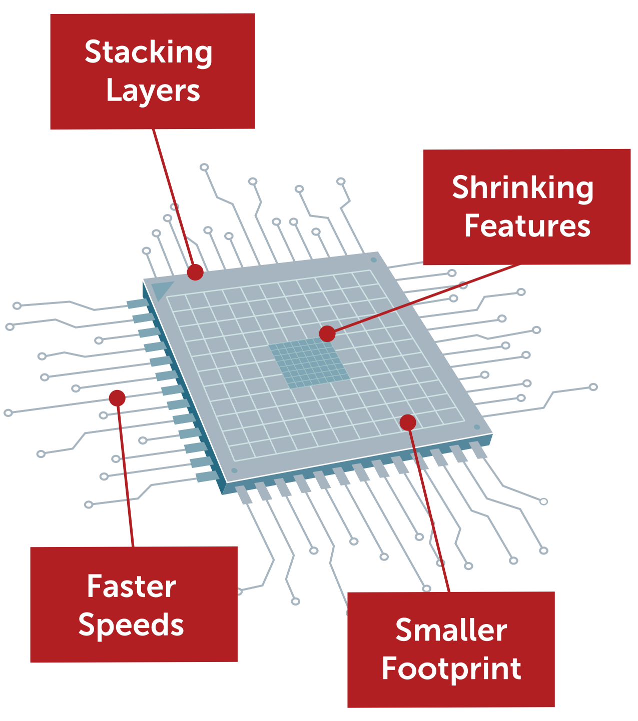
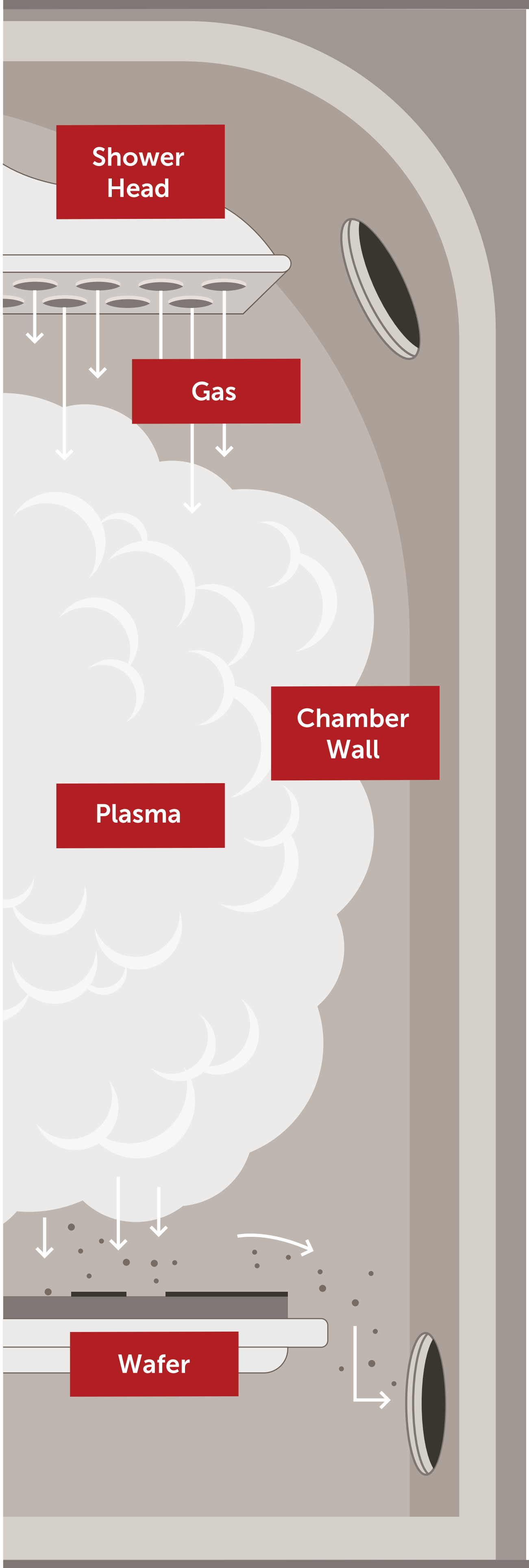
Three Successful Precision Engineered Techniques for Coating Plasma Chamber Components

Demand for high-density digital storage is skyrocketing and achieving reliability in high volume manufacturing has been problematic. To overcome the problems, manufacturers must change device design, necessitating new materials and fabrication processes.

The complexity of the new design also amplifies the need for precise environmental control inside deposition chambers. To maintain etch rates and the electrical integrity of deposited layers, manufacturers have to adopt advanced coating techniques.



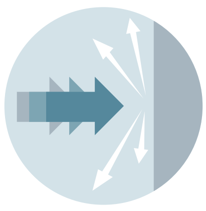
PROTECTING CHAMBER PARTS AND COMPONENTS



Traditionally, chamber parts and components in contact with wafers or chemicals were coated with metal oxides using plasma spray, anodization, and vacuum kinetic spraying.

Conventional oxide coatings offer some chemical protection and extend the life of components, but can impact long-term process control. Oxide coatings degrade from the corrosive chemicals used in plasma chambers. Particles shed from the coatings then deposit on the wafers, potentially causing device failures.


Corrosive Deterioration


Process Control Issues


Wafer Contamination

PRECISION-ENGINEERED COATING

Precision-engineered coatings utilize vacuum-thin film technologies and produce coated components that can better resist corrosion and oxidation.

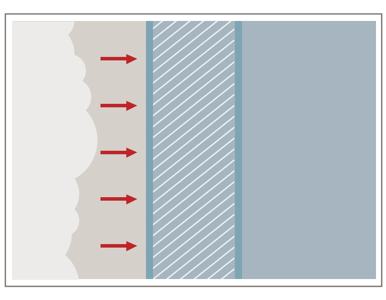

Corrosion Resistant


Coating Options


Custom Engineering

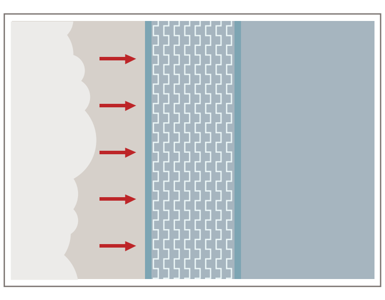
ADVANCED COATING METHODS

Physical Vapor Deposition (PVD) Yttria and/or Alumina



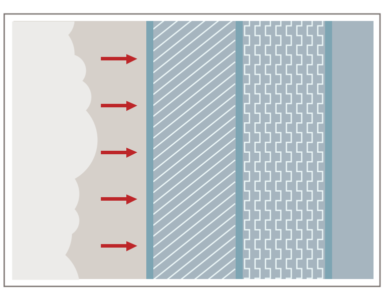
- Produces denser, cleaner coatings than other coatings methods
- Are best suited for etching tools
- Generates few particles
- Achieves higher deposition rates.
- Reduces cost through thicker coatings

Atomic Layer Deposition (ALD) Yttria and/or Alumina



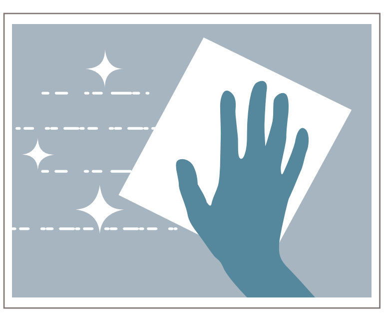
- Are particularly suited for critical chamber components or elements with complex interior geometry
- Attains more uniform and cleaner coatings
- Provides a reliable, high-purity, nearly defect-free protective barrier
- Extends component life and reduce contamination

Hybrid (Multilayer)



- Combines the benefits of ALD and PVD layers
- Enables ultimate customization for maximum flexibility
- Creates a robust composite blend
- Withstands varying chemical environments

SURFACE PREPARATION AND CLEANLINESS



Surface preparation and cleanliness are key factors that negatively affect coating performance. The methods of surface preparation and cleaning are highly dependent on type of substrate material.

Rough surfaces could increase susceptibility to erosion/chemical attack, causing more particle shedding and decreased overall device yield and tool productivity. In general, a smoother substrate surface finish is extremely beneficial, although the level of smoothness could vary with substrate type.

Micro-contaminated surfaces can lead to poor adhesion of coatings, which could result in coating adhesion problems, particle shedding and process drift and therefore decreasing yield and productivity. It is essential that parts be cleaned well before coating before PVD and ALD coating.

IMPROVING COST OF OWNERSHIP

PVD and ALD coatings are cost-effective for all components

- Improve corrosion and erosion resistance
- Enable tighter process control
- Increase yield
- Lower component downtime and extend life

Learn More

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