

Wafer Chuck and Pedestal Assemblies



Heated chucks and shafted pedestal heaters are used in critical in-situ wafer processing applications where proximity to the wafer requires precise thermal, electrical, metallurgical and mechanical specifications. Watlow has developed several innovative solutions that address specific application requirements from CVD to wafer probing.

Combining dissimilar metals by advanced machining and welding processes is a demonstration of Watlow's innovative culture. A specific example of this process is an aluminum pedestal heater with a stainless steel shaft. The stainless steel material reduces the thermal losses through the shaft and results in precision perpendicularity with a superior vacuum seal. The shaft provides an ideal way to get the lead wires out of the process chamber. The heated pedestal achieves excellent temperature uniformity and is delivered with semiconductor-grade cleaning and packaging.

Applications

Chemical Vapor Deposition (CVD)

Dry etch

Ashers

Photolithography track

Wafer probers

IFC E-Beam (Interference Fit Construction Electronic-Beam) Welded Pedestal Assembly

IFC construction is ideal for high temperature and corrosive vacuum environments. Watlow's IFC manufacturing process secures tubular heater elements and optional cooling tubes into the substrate material without the use of a secondary vacuum brazing operation. The assembly is subsequently electron beam welded for vacuum service, including shafts, flanges or other customer fittings. IFC heater assemblies are ideal for PECVD applications, delivering excellent temperature uniformity performance in a demanding process environment.

Specifications

- Performance to 700°C (1292°F)
- Materials
 - Inconel®
 - 304 and 316 Stainless Steel
 - Nickel
- Tubular heater element and optional heat/cool tube
- Perpendicularity to better than 0.1 mm
- Flatness to 0.005 mm on 300 mm wafer chuck



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Aluminum Heat or Heat/Cool Pedestal Assemblies

Tubular or cable heaters are precisely formed and cast into aluminum using Watlow's proprietary low pressure casting process. Heater assemblies are precision machined to customer specifications such as wafer lift pin holes, vacuum connection features and vacuum groove patterns. Similar and dissimilar metals can be e-beam welded to form a shaft, providing an exit for electrical lead wires.

Specifications

- Performance to 450°C (842°F)
- Materials depending on the metallurgical, thermal and mechanical properties required
 - Pure (99.7 percent) aluminum – Alloy 170.1
 - Aluminum Alloy 356
 - Aluminum Alloy 319
- Perpendicularity to better than 0.1 mm
- Flatness to 0.005 mm on 300 mm wafer chuck
- Optional cooling tube

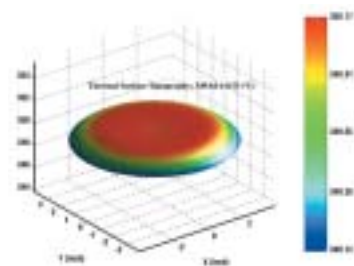


Sandwiched Pedestal Assemblies

A sandwich pedestal assembly is a combination of a mica foil, Kapton®, silicon rubber or other heater combinations that are trapped between two or more machined metal plates or ceramic plates. The assembly may include combinations of sensors, controllers, cabling and other electrical or mechanical components. This construction is excellent for unique geometry heater assemblies, and certain high temperature and process material applications.

Engineering Support

Watlow uses in-house engineering capabilities to optimize the design and performance of pedestal heater assemblies. These include the use of finite element analysis (FEA) software to evaluate the thermal and mechanical characteristics for a part in typical wafer processing boundary conditions. For more complex analysis, the services of Single Iteration, Watlow's engineering services division, offer additional technical skills and resources at the expert level. Please see page 31 for more information regarding Single Iteration.



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