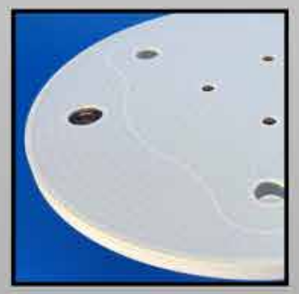
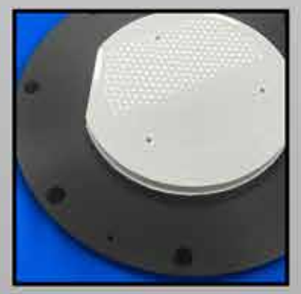
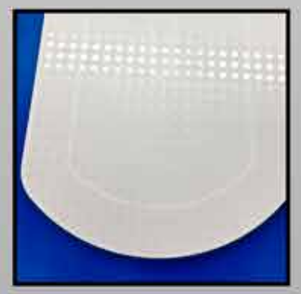
CERAMIC ESC PROPERTIES

CRITERIA	SPECIFICATION AI2O3
Purity	> 99.9%
Porosity	< 2%
Hardness (HV0.3)	> 800
Thermal Conductivity m·K	> 30
Adhesion Strength (PSI)	> 6000
Dielectric Constant @ 1MHz	7.2~7.5 @ 1MHz
Dielectric Strength (kV/mm)	> 20
Volume Resistivity (Ω·cm) @ RT	> 1.0 X 10E15
Current Leakage @ 4kV (μA)	< 0.25μA at 0.25mm thick
ESC Clamping Voltage	+/- 1kV to +/- 4kV
Clamping Force	> 50 Torr
Helium Leak Rate	< 1sccm







Hybrid Electrostatic (HES) Industries, LLC was formed in 2019 however, the development, design, and manufacturing team has over 20 years of experience. The name has changed a few times, but the experience, support, and dedication is still the same!

1988	1993	2001	2012	2019
IBM's Watson Labs develops electrostatic clamping for holding silicon wafers.	Dorsey Gage Co. develops the manufacturing techniques and procedures to commercialize the ESC.	Praxair Surface Technologies acquires Dorsey Gage Co. and diversifies with ceramic technology.	FM Industries acquires Praxair ESC Business.	Hybrid Electrostatic (HES) Industries acquires FM Industries Ceramic ESC division.

HES INDUSTRIES, LLC

HYBRID ELECTROSTATIC CHUCKS

With over 25 years of experience, Hybrid Electrostatic (HES) Industries, LLC applies a consultative approach to deliver personalized ESCs that meet and exceed customer's expectations.

Wide range of electrostatic chucks for semiconductor tools such as CVD, plasma etch, ion implant, and metrology.

Chucks range in size from 100mm to 450mm.

HES Industries, LLC designs, manufactures, and completely tests these products for field proven performance as required by each customer.

Proven for high purity, low-particle generation, and long process life.

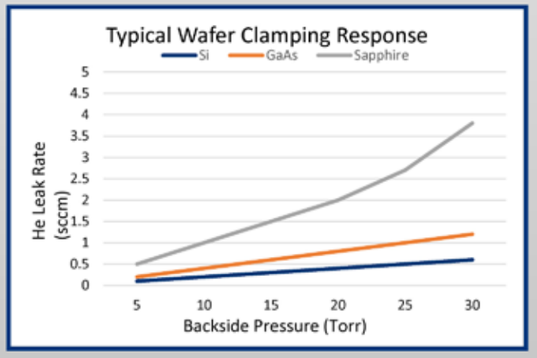
HES Industries works with its customers to develop complete solutions for complex product development.

HYBRID ELECTROSTATIC INDUSTRIES, LLC

700 South Drive, Suite 104
Hopewell Junction, New York, 12533
845-897-1020
www.hybridesc.com

HYBRID ESC WITH INTERDIGITATED ELECTRODE DESIGN

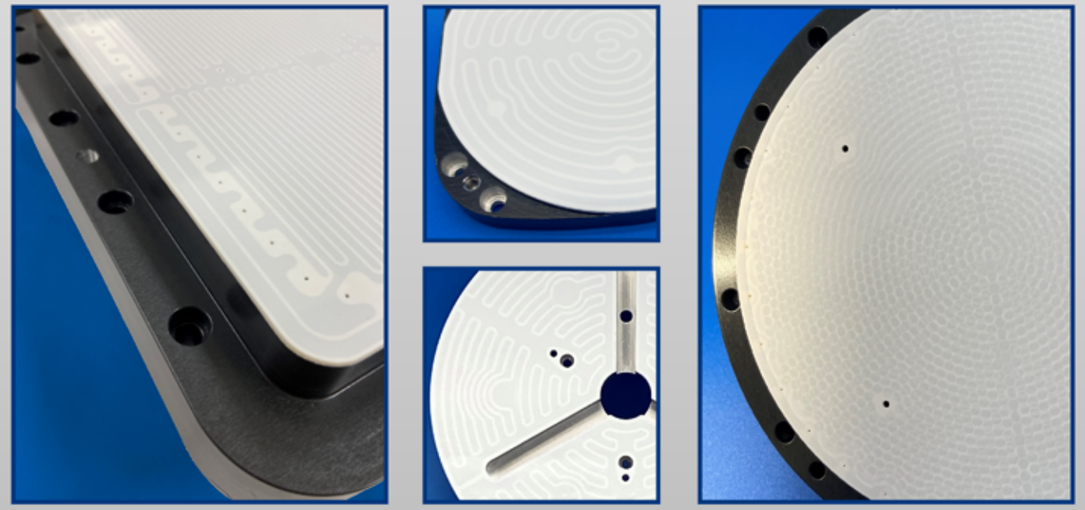
There is a high demand in some semiconductor processes to clamp dielectric substrates such as sapphire, glass, and more. HES Industries has developed new interdigitated electrode designs and manufacturing processes. This advanced design and manufacturing methodology allows customers to choose an optimal design based on their specific process requirements.



ESC DESIGN PARAMETERS

Size & Geometry	100mm - 450mm; Custom design base plate
Material	Anodize Aluminum, Alumina, DLC, SiN, SiO2, Ti
Electrode Designs	Monopole, Bipole, Multi-pole, Interdigitated
Geometric Tolerances	Flat and parallel .0002 - .0004 inch (< 5µm - 10µm)
Surface Finish	Wafer clamping surface <2µ inch Ra (0.05µm)
Surface Patterning	Custom mesa pattern to reduce particle transfer
Refurbishments	Ceramic ESC surface cleaning, removal & replacement
Inspection & Performance Testing	Dimensional accuracy, Electrical performance, Vacuum integrity, Backside gas leakage, Wafer clamping and Release
Analysis Capability	Thermal & Electrical Performance, SEM & EDX using FEM & CFD
Production Volume	Prototype to High Volume
Industry Focus	Tool Manufacturers Semiconductor Lithography Solar LED MEMS
Applications	Etch Process HPD-CVD and PVD Ion Implantation Metrology Dielectric Substrates (LED and Solar Applications)
Industry Standards	Compliant to Major OEM Specifications including Quality, Packaging, Performance, and Cleanliness
File Formats	Available to import most software; Solidworks, IGES, STEP, DXF

INTERDIGITATED, MONOPOLE, BI-POLE & AC ELECTRODE DESIGNS



ESCs FOR FAST CLAMPING AND RELEASE TO INCREASE THROUGHPUT

MATERIAL AND PERFORMANCE PARAMETERS

Product Description	Advanced Interdigitated Electrode ESC
Clamped Substrate Material	Silicon, Sapphire, Glass, GaAs, SoG
Electrode Separation	> 0.3mm
Breakdown Voltage	> 20kV/mm
Typical Operation Voltage	± 1000V to ± 4000V
Clamping Force/Pressure	> 50 Torr with < 2 sccm Helium Leak Rate
Release & Clamp Time	< 1s

Our engineers work cooperatively with customers to provide an optimized total ESC solution for improved tool performance. Our proprietary manufacturing process enables HES Industries to fabricate ESCs from 100mm to 450mm with customer specified geometries. All ESCs feature high clamping forces, quick chuck and de-chuck times, and anti-arc design for high bias application.