GEM-D2 ALD System

Molecular Innovation™

The GEM-D2 ALD System is specifically designed to meet the needs of challenging high aspect ratio (HAR) deposition applications where coverage uniformity is paramount. In a small footprint suitable for the research environment, GEM-D2 has features rivaling some of the most sophisticated semiconductor production tools.

ARRADIANCE® GEM ALD Process Systems deposit conformal metal, semiconductor and insulating films on high aspect ratio (HAR) structures on a wide variety of substrates.

Uniformity

The uniformity of thin films can determine whether a process or device works or not. The GEM-D2 ALD system is meticulously designed to provide the user with the most uniform films possible, even in challenging HAR through-hole applications. Some key features of the system include:

- Convective, as opposed to conductive, heating to maintain temperature uniformity of the substrates. Temperature is monitored right at the substrate holder using a sensor embedded in the support posts, rather than on a heated plate like other ALD systems. This sensor is thermally isolated from the rest of chamber insuring that the actual temperature of the substrates is measured.
- Showerhead gas delivery with a linear array of injectors insures uniform gas distribution over the entire substrate holder. The substrate holder orients samples to present equal top to bottom precursor access promoting uniform through-pore depositions and 3D coatings.
- Flow design also allows for uniform and conformal growth of films from precursors that have a CVD growth component.

Process Control

Precise films require state-of-the-art controls. The Arradiance Control System maintains complete control over key deposition parameters such as exposure, pulse and purge, carrier gas background pressure, substrate heating and cooling, substrate position and orientation, and precursor introduction.

- Precursor temperature is precisely controlled from bottle to reaction chamber. Precursor gases see only increasing temperature as they move toward the chamber, insuring no condensation of gases in the precursor lines.

- Precursor flow is precisely controlled. All precursor lines are separate. There is no mixing of gases until they reach the chamber, so there is no contamination in the manifold lines.
- Exposure control is critical in growing ALD films with the desired conformality. Partial pressure and residence times are precisely controlled through the use of a downstream vacuum valve. Precise control of exposure produces precise films.
- Minimum chamber volume allows for excellent temp-erature control, fast warm-up times, higher throughout and reduced precursor usage.
- Quantitative determination of gas feed port size to insure uniform distribution from a single feed line for each gas
- Simple, low cost maintenance and cleaning procedure.
- Sensor embedded in the SS posts that are supporting the aluminum substrate holder ensures accurate temperature monitoring

Easy Maintenance

Simplified tool maintenance results from the use of a modular chamber design, isolation of sensors during precursor pulsing and an active, thermal decomposition trap for un-reacted precursor removal prior to the vacuum pump.

- The modular chamber design allows for easy service and cleaning. The parts in the chamber can be swapped out, allowing for cleaning of unwanted deposition or conta-minants with very little down time.
- Key sensors such as the substrate temperature sensor and the chamber pressure sensor are isolated from reactive gases insuring long life with minimum downtime and maintenance.
- Reactive gases that are not deposited are sent through an abatement system consisting of a heated wire mesh filter that decomposes harmful gases before they reach expensive vacuum pumps where they can deposit unwanted films.
- Small (23”x26”) footprint allows room for 360⁰ access in the tightest laboratory environment.

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System Specifications	
	GEM-D2
Substrate size	1-5 76mm wafers 1-5 51mm wafers 1-25 25mm wafers Up to 35mm x 50mm x 60mm 3D solids
Dimensions (w x d x h)	575 x 644 x 1100 mm
Cabinet	Powder coated, removable panels, compact gas/power/vac input panel, EMO
Deposition Modes	Dynamic flow with equal front and back exposure for quick <100:1 aspect ratio deposition; Static flow for >100:1 aspect ratio
Power w/o computer	Peak 120VAC-1600W w/o pump Peak 120VAC-2700W w/ pump
Control	Full windows based GEMFlow™ software suite written exclusively for the GEM-D2; Import/export of Excel compatible recipes and data
Substrate Temperature	RT - 300°C ± 1°C within 25 wafer batch ± 0.2°C within single 25.4mm wafer
Substrate Temp Control	Hot wall reactor
Heat up time	<20min from RT to working temperature using high pressure heat up mode
Deposition Uniformity	< ± 1 % within wafer < ± 2 % batch-to-batch
Chamber surface area/volume	260 cm^2 / 300 cm^3
Precursor Specifications	
Precursor Handling	2 precursor lines standard No mixing of precursor lines at any point Linear shower head array for improved flow uniformity
Valves	3-way high speed ALD valves with discrete heaters and temp control (optional)
Precursor Cylinders	150cc bottles with custom molded heating jackets (optional)
Carrier/Venting Gas	Integrated inert gas purifier and high speed MFC with continuous purge
Options	Options available for ultra-low vapor pressure solids and for direct liquid delivery 2 additional precursor lines 3 zone temperature control for each precursor
Safety Specifications	
Precursors	HW and SW interlocks to prevent air exposure
System	Integrated EMO; separate interlocked chemical and high voltage cabinets Small modular components enable quick part exchange and easy PM procedures
Options	Gas abatement using thermal decomposition trap Integrated UPS for controlled shutdown continued processing for outage up to ½ hour.Ventable cabinet High temperature single wafer heater, up to 400°C with integrated in-situ thermal anneal control.