

# GEMStar-8™ Benchtop ALD System



Molecular Innovation™

*The GEMStar-8 benchtop ALD system is designed to meet the challenges of uniform, conformal, thin-film depositions over high aspect ratio features, on a broad range of substrates, in a compact, economical package.*

*A small, lightweight machine for heavyweight R&D efforts, GEMStar makes optimal use of lab space and research budgets.*

ARRADIANCE® GEMStar ALD systems deposit metal, semiconductor and insulating films with superior electrical and barrier properties. They are designed for uniform, conformal films on planar and high aspect ratio structures on a broad range of substrates.

Some key features of GEMStar include:

- ◆ Small (32"x25"x12") footprint and benchtop design allow for easy placement in any lab environment
- ◆ Chamber accommodates up to 8" (200mm) diameter wafers or 3D objects up to 1.35" (34mm) tall or micro/nano scale powders.
- ◆ Up to 300°C hot wall design with convective heating to achieve  $\pm 1^\circ\text{C}$  temperature uniformity across the substrate.
- ◆ Exposure control is critical for conformal ALD films on high aspect ratio structures. Partial pressure and residence times are precisely controlled with a downstream vacuum valve.
- ◆ Standard set of 8 ALD precursors can be run concurrently, enabling a variety of thin films and multi-component film stacks.
- ◆ Standard 6 precursor bottles, including 2 heated (4 heated optional) up to 140°C for low vapor pressure precursors.
- ◆ Single inert gas assist line for ultra low vapor pressure precursor.
- ◆ Up to 150°C dual zone heated gas manifolds.
- ◆ Showerhead gas delivery with a horizontal linear array of injectors insures uniform gas distribution over the entire substrate holder.
- ◆ Double-sealed, differentially pumped chamber eliminates ambient leakage during sensitive metal depositions.
- ◆ Standard 2.75" CF port allows attachment of optional QCM or particle holder.



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## GEMStar Operational Control

Precise films require state-of-the-art controls. The Arradiance System maintains complete control over key deposition parameters such as temperatures, exposure, pulse, purge, background pressure.

- ◆ Precursor temperature is precisely controlled with increasing temperature from bottle to manifold to reaction chamber, insuring no condensation of gases in the precursor lines.
- ◆ Metalorganic and oxidizer/reducer precursors are mounted on separate manifolds, increasing the lifetime of valves and eliminating film growth on manifold walls.
- ◆ Quick flow manifold and high conductance foreline yield fast purge and fast cycle times.
- ◆ High speed ALD valves ensure precise precursor dosage.
- ◆ Internal GEMStar USB control module.
- ◆ User created and saved recipes allow flexibility and batch-to-batch consistency.
- ◆ Diagnostic system logging creates traceable data of all system parameters during all runs.

## Easy Maintenance

Simplified system maintenance results from:

- ◆ The modular system design allows for easy swapping out parts for service and cleaning, with minimal down time.
- ◆ Convenient benchtop access from the top and back to critical parts, precursor bottles, vacuum, power and gas connections.
- ◆ Exhaust gases are flowed through a thermal decomposition trap prior to the vacuum pump.



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System Specifications	
Substrate size	Up to 8" (200mm) wafer or square substrate Up to 1.35" (34mm) tall 3D solids, or a stack of 9 wafers Standard 8" (200mm) diameter end effector
System Dimensions (w x d x h)	32" x 25" x 12" (82cm x 64cm x 31cm) – fits on standard desktop or lab bench
System Weight	140 lbs
Chamber surface area/volume	250 in <sup>2</sup> / 130 in <sup>3</sup> (1610 cm <sup>2</sup> / 2130 cm <sup>3</sup> )
Deposition Modes	Dynamic flow with front and back exposure for <100:1 aspect ratio deposition Static flow for >100:1 aspect ratio deposition
Substrate Temperature	25°C – 300°C < ± 1°C up to 8" wafer
Deposition Uniformity	< ± 1 % within wafer (Al <sub>2</sub> O <sub>3</sub> from TMA and H <sub>2</sub> O) < ± 2 % batch-to-batch (Al <sub>2</sub> O <sub>3</sub> from TMA and H <sub>2</sub> O)
Control System	GEMFlow™ software suite, Windows® 7 based, advanced and basic GUIs Import/export of Excel compatible recipes and data Internal GEMStar USB control module
Shell / Cabinet	Tool removable top panel with rear facilities interface CF 2.75" metrology interface
System Options	400°C Heated Chuck Glovebox Interface Pump package with Thermal Abatement unit for exhaust gases Ozone Generator module Particle Coater
Precursor Specifications	
Precursor Handling	8 precursors standard (4 metalorganics, 4 oxidizers/reducers) 2 heated sources standard (up to 4 optional)
Inert gas vapor pressure assist	1 metallorganic source with inert gas assist for ultra low vapor pressure precursors
ALD Valves	2-way high speed ALD valves integrated into quick purge manifold
Precursor Bottles	6 removable 150cc bottles with individual shut off valves
Precursor Thermal Control	Heating jackets for precursor bottles with temperatures up to 140°C ± 1°C
Manifold Thermal Control	2 Manifold zones with temperatures up to 150°C ± 1°C
Carrier/Venting Gas	Script settable high speed MFC 0–200 sccm
Facilities Requirements Specifications (see documentation)	
Gases	80 ± 5 psi regulated clean dry air (1/4" Swagelok) 20 ± 5 psi High purity N <sub>2</sub> (>99.999%); N <sub>2</sub> purifier recommended) 20 ± 5 psi, 2 standard Process Gas ports
Power	IEC C19 20 Amp AC plug/connector 110 – 120 VAC; 50/60Hz; 20 Amps
Vacuum	Recommended 2-stage, rotary vane vacuum pump; >12 cfm pump capacity NWKF 25 sized foreline