

Atomic Layer Deposition Coating Services



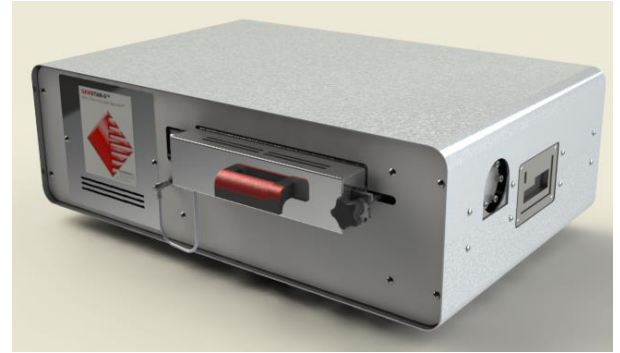
Arradiance offers coating services to industry, academia and government labs using GEMStar benchtop ALD systems. The service covers a broad range of thermal and plasma ALD films, substrates, surface features, and applications.

At the forefront of ALD technology, Arradiance has considerable experience developing complex nanofilm structures with superior electrical, passivation and barrier properties.

ARRADIANCE[®] coating services leverage the unique capabilities of GEMStar and knowhow of ALD technology to deposit insulating, semiconducting and metal films with superior properties. Access to a variety of analytical instrumentation allows rapid process development and execution.

Specializing in high aspect ratio, high surface area applications, nanofilms have been developed for:

- ◆ Moisture barrier for electronics packaging, MEMs sensors, solar cells, LEDs, displays
- ◆ Electrode and electrolyte coatings for advanced batteries and fuel cells
- ◆ High-k dielectrics for semiconductor devices
- ◆ Coatings for nanoparticle catalysts
- ◆ Biosensors, medical devices and genomics
- ◆ XRAY and optical components
- ◆ Secondary electron emission control
- ◆ Conductive coatings for charge dissipation
- ◆ Coatings in microlattice structure and networked mesoporous polymer/carbon membrane



GEMStar-8™ Benchtop ALD System

Arradiance ALD Coating Processes

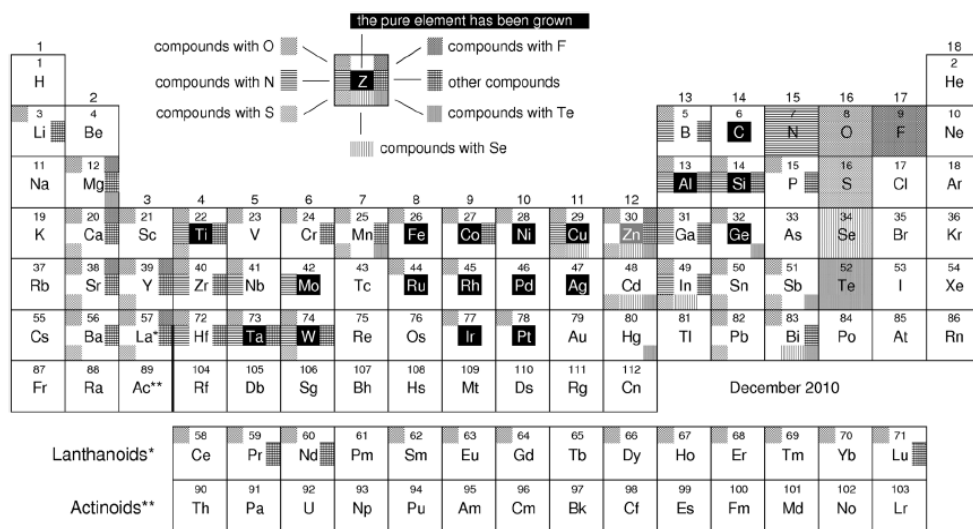
Representative examples of ALD films in GEMStar:

Al ₂ O ₃	Ta ₂ O ₅	Pt
HfO ₂	TiO ₂	Ru
MgO	Y ₂ O ₃	TiN
SiO ₂	ZnO	WN
SnO ₂	ZrO ₂	Nanolaminates

Arradiance coating service engagement entails:

- ◆ Understand application–film properties, thickness; understand substrate type (e.g. wafer, powder), material, size, surface features (e.g. aspect ratio, surface area), temperature, and handling.
- ◆ Establish development and metrology requirements, provide budget / lead time consistent with effort level and customer needs.
- ◆ Following completion, discuss results of customer functional testing and jointly decide on next steps.

Molecular Innovation™



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The universe of ALD Films



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System Specifications

Substrate size	GS-4 XT: up to 4" (100mm) wafer or square substrate GS-6 XT: up to 6" (150mm) wafer or square substrate GS-8 XT: up to 8" (200mm) wafer or square substrate All systems can fit up to 1.3" (33mm) tall 3D solids, or a stack of 5 or 9 wafers
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	150 lbs
Deposition Modes	Dynamic flow for high speed and low aspect ratio deposition. Static flow for conformal deposition on high aspect ratio features and powders.
Control System	GEMFlow™, Windows® based software suite with advanced GUIs. Import/export of Excel compatible recipes and data. Internal GEMStar USB control module.
Substrate Temperature	25°C – 300°C < ± 1°C up to 8" wafer
Deposition Uniformity	< ± 1 % (1σ) within wafer (Al ₂ O ₃ from TMA and H ₂ O) < ± 2 % (1σ) batch-to-batch (Al ₂ O ₃ from TMA and H ₂ O)
Shell / Cabinet	Stainless Steel with removable top panels and rear facilities interface
Compliance	CE, CSA
System Options	Glovebox Interface 500°C Heated Chuck Ozone Generator module Thermal Abatement Unit Pump Package GS-6 XT and GS-8 XT upgradeable to Plasma Enhanced ALD

Precursor Specifications

Precursor Handling	GS-4 XT: 4 ALD precursor valves standard (2 metalorganics, 2 oxidizers) GS-6 XT & GS- XT: 8 ALD precursor valves standard (4 metalorganics, 4 oxidizers)
Precursor Thermal Control	Up to 200°C heated manifolds and 2 heated sources standard (up to 4 optional)
Inert Gas Assist	1 metalorganic source with inert gas assist for ultra low vapor pressure precursors
ALD Valves	High-speed, 2-way ALD valves with 10msec actuation, integrated into manifold
Precursor Cylinders	150cc, DOT certified, stainless steel cylinders with manual shut-off valves
Carrier/Purge/Vent Gas	N ₂ , high-speed MFC, 200sccm

Facilities Specifications

Gases	80 ± 5 psi regulated Clean Dry Air (1/4" Swagelok) 20 ± 5 psi High purity N ₂ (>99.999%); N ₂ purifier recommended 5 – 20 psi Process Gas supply
Power	110 – 120 VAC; 50/60Hz; 20 Amps IEC C19 20 Amp AC plug/connector
Vacuum	Recommended 2-stage, rotary vane vacuum pump. >12 cfm pumping capacity with NW25 sized foreline (Edwards E2M18).