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

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Arradiance ALD Coating Processes

Representative examples of ALD films in GEMStar:

<table>
<thead>
<tr>
<th>Material</th>
<th>Material</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al₂O₃</td>
<td>Ta₂O₅</td>
<td>Pt</td>
</tr>
<tr>
<td>HfO₂</td>
<td>TiO₂</td>
<td>Ru</td>
</tr>
<tr>
<td>MgO</td>
<td>Y₂O₃</td>
<td>TiN</td>
</tr>
<tr>
<td>SiO₂</td>
<td>ZnO</td>
<td>WN</td>
</tr>
<tr>
<td>SnO₂</td>
<td>ZrO₂</td>
<td>Nanolaminates</td>
</tr>
</tbody>
</table>

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.

The universe of ALD Films

# 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 (Al₂O₃ from TMA and H₂O)  
|                        | < ± 2 % (1σ) batch-to-batch (Al₂O₃ from TMA and H₂O)  
| 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-8 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 | N₂, high-speed MFC, 200ccm  

# Facilities Specifications

| Gases | 80 ± 5 psi regulated Clean Dry Air (1/4” Swagelok)  
|       | 20 ± 5 psi High purity N₂ (>99.999%); N₂ 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).  

Atomic Layer Deposition Coating Services

Arradiance, Inc. ● 142 North Road, Suite F-150 ● Sudbury, MA 01776 ● www.arradiance.com ● Main: (800) 659-2970