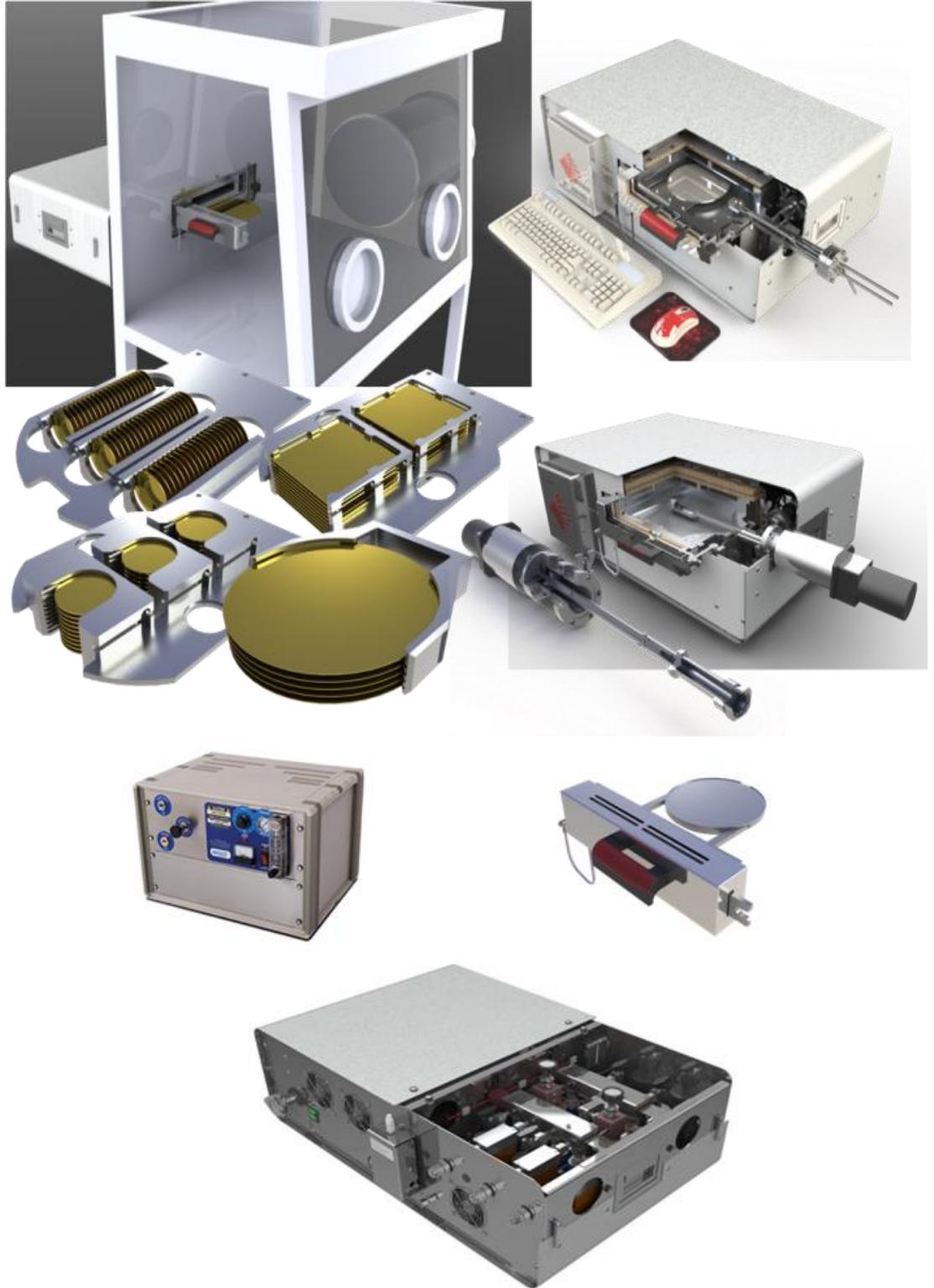


GEMStar™ Optional Features



Molecular Innovation™



GEMStar™ Optional Features



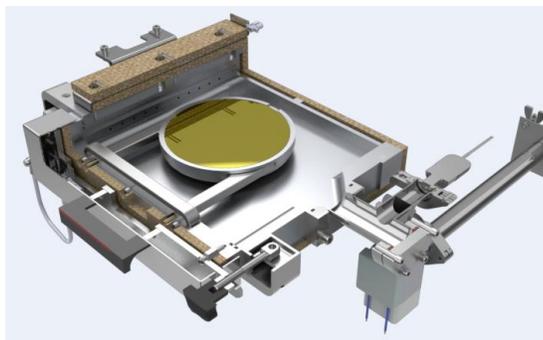
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500°C Heated Chuck Option

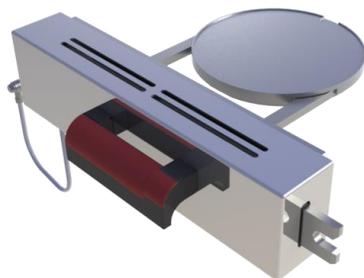
The GEMStar benchtop, hot-wall ALD system enables uniform, conformal thin-film depositions over high aspect ratio features, in a compact, economical package. The heated chuck option extends the system capability to higher ALD process temperatures of 500 °C.

ARRADIANCE® GEMStar hot-wall design gives excellent temperature uniformity inside the chamber which enables uniform, conformal ALD films over high aspect ratio features. The chamber walls and door are designed to reach up to 300°C which covers most common ALD processes. The heated chuck option extends the system capability to higher temperature ALD processes up to 500°C.



Cut-out view of the 450°C Heated Chuck

- ◆ Allows up to 500°C hot plate operation while heating the chamber walls up to 300°C.
- ◆ Plug-compatible door module allows easy swap with standard 300°C hot wall operation.
- ◆ Stainless steel heater design with retained 6" aluminum chuck to achieve temperature uniformity of substrate.
- ◆ All external temperature safety standards maintained with the option.



Pulsed CVD Option

The GEMStar benchtop, hot-wall ALD system with pulsed CVD option offers the combined benefits of uniform, conformal thin-film depositions over high aspect ratio features typical of ALD, with the higher deposition rates of a CVD process.

ARRADIANCE® pulsed CVD option, unique in a system of this size, features MFC controls on the 2 oxidizer/reducer precursor gas lines. Typically used for metal films which require control and high aspect ratio capability of ALD combined with higher deposition rates of CVD, offering the researcher greater flexibility and ability to deposit a broader range of materials.

The GEMStar ALD and Pulsed CVD system uses surface self-limiting reactions in ALD mode and traditional CVD reactions to deposit conducting metal nitride and pure metal thin films with good uniformity, conformality and material purity. Examples include NiNx, Ni, WNx, and many more.

- ◆ Fully controlled through the system software for maximum flexibility of use in complex recipes
- ◆ Two separately controlled MFC channels for CVD gases
- ◆ Manifold valves support continuous flow



GEMStar™ Optional Features



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Glovebox Interface Option

The unique front door design of the GEMStar enables convenient interface to the side or back of any glovebox thus enabling cutting-edge research on air sensitive materials.

ARRADIANCE® GEMStar Front Loading ALD Systems provide a unique platform for interfacing to the side or back of any standard glovebox.

- ◆ **Space in the glovebox:** The access port for the swing-out door of GEMStar built into the back or side of the glovebox maximizes the usable workspace inside. No space is taken up in the middle of the glovebox by a large chamber.
- ◆ **Ease and Safety of Loading/Unloading:** The substrate holder swinging out with the side-mounted door of GEMStar makes it easy and safe to load/unload substrates with minimal exposure to the chamber and minimal particle introduction.
- ◆ **Heat management:** In GEMStar, most of the chamber heat is outside of the glove box, unlike vertical chambers which add significant heat load inside the glovebox which has to be actively managed.
- ◆ **Access to precursors and maintenance:** GEMStar mounted on the back or side of a glovebox retains its easy, waist-high access for precursor changeover and maintenance, unlike vertical chambers mounted under the glovebox with challenging access for maintenance.



GEMStar Side-mounted Interface to Glovebox

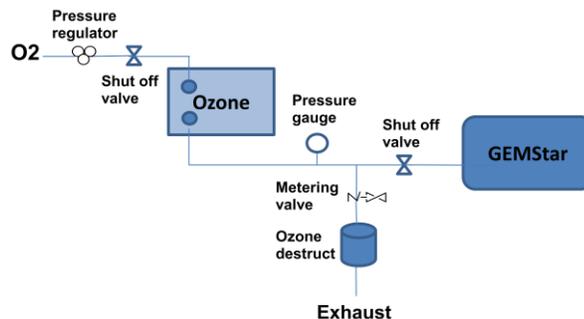
Ozone Generator Option

As a strong oxidizer, Ozone enables lower temperature ALD of oxides and can be readily integrated through a gas port on the back of GEMStar and controlled through an ALD valve.

ARRADIANCE® GEMStar systems can deposit uniform, conformal ALD Oxide films with superior electrical and barrier properties, at lower temperatures, using Ozone chemistry.



- ◆ Ozone is a stronger oxidizer than water and allows lower temperature ALD oxide depositions on temperature sensitive polymer substrates
- ◆ With its higher reactivity, Ozone allows a broader range of precursor chemistries.
- ◆ Ozone can also be used for *in-situ* cleans.
- ◆ Ozone is generated on-site from an O₂ discharge, with continuous flow to the exhaust through an ozone destruct. The Ozone is connected to a process gas port on the back of GEMStar.
- ◆ Ozone dose is controlled through an ALD valve on the oxidizer manifold with GEMFlow™ software.



GEMStar™ Optional Features



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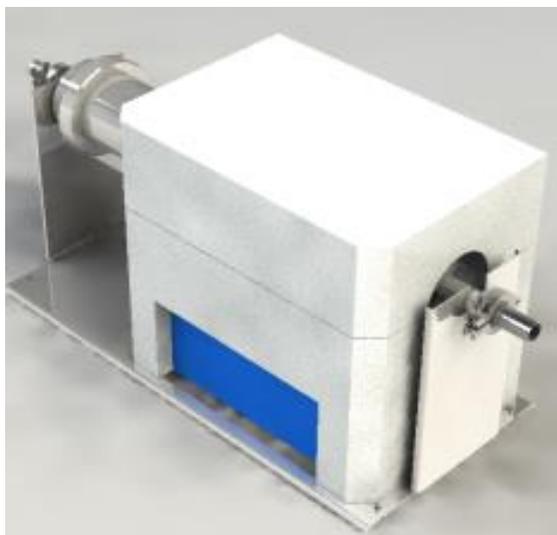
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Exhaust Abatement Option

Unreacted Metalorganic ALD precursors from GEMStar are decomposed in the abatement system and the particles filtered out before reaching the pump, thus improving safety and reducing pump maintenance.

ARRADIANCE® Exhaust Abatement option is conveniently connected between the GEMStar system and the pump, and provides significant safety, environmental and cost benefits. The reduced pump maintenance also reduces system down-time.

- ◆ The in-line furnace is typically operated at 700°C which can break down most commonly used metalorganic precursors. It is capable of reaching temperatures up to 1100°C.
- ◆ The oxide or metal particles generated in the furnace are captured in a metal-mesh particle trap and prevented from reaching the pump.

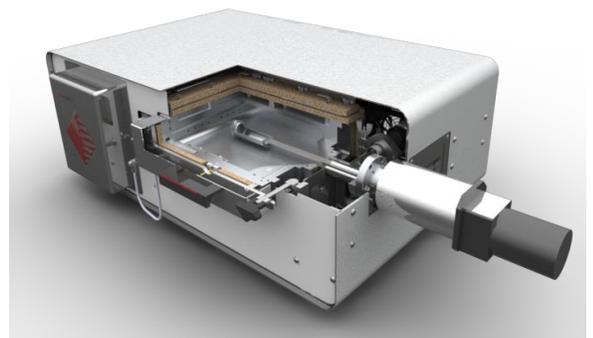


Particle Coater Option

All GEMStar systems provide a standard KF40 port which is useful for in-situ metrology instruments such as QCM and RGA. It is also a convenient port used for the proprietary rotating particle coating tool.

ARRADIANCE® GEMStar systems can deposit uniform, conformal ALD films with superior electrical and barrier properties on a wide range of substrates including micro/nano scale powders.

- ◆ The GEMStar chamber size can accommodate up to 8" (200mm) diameter wafers, or 3D objects up to 1.3" (33mm) tall, or powders.
- ◆ Up to 300°C hot-wall design with convective heating can achieve $\pm 1^\circ\text{C}$ temperature uniformity in 3-dimensional space thus enabling conformal depositions over powders.
- ◆ 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.
- ◆ Specially designed particle holder can be conveniently connected to GEMStar through the KF40 metrology port.
- ◆ Quick disconnect particle canister facilitates loading and unloading of particles.
- ◆ Customizable screen filter on particle canister.
- ◆ Seal-less magnetic drive for continuous rotation with user settable RPMs to facilitate conformal coatings around the particles.



GEMStar ALD system with cut-out showing the particle coater option