

## DEVELOPER



Specifically designed for R&D, the **Developer** combines the production proven design and system components of the Revolution, our fully automatic ALD wafer line, with the simplicity and flexibility of the Glider, our industrial ALD coating line, to deliver unmatched performance, flexibility, reliability and safety. The Developer is field upgradeable to accommodate the ever-changing needs of scientists and engineers. It is also designed for seamless transition to production with both the Glider and Revolution systems.

**Performance:** Developer is the only R&D tool for ALD that delivers blazing fast deposition compatible with large-scale production. With Sundew's patented *SMFD-ALD™*, new powerful capabilities are finally available in a low cost system that fits most R&D budgets. Sub-second ALD cycle times allow efficient and rapid exploration of applications requiring thick films. Proprietary sources and processes enable new applications with unprecedented reproducibility and control. Film growth is monitored with better than 5% of monolayer resolution with an integrated QCM for finer process exploration and optimization and the finest growth details. At last - Developer allows you to unleash the full potential of atomic layer deposition.

**Capabilities:** With its unmatched, extremely high chemical utilization efficiency, the developer is ideal for exploration of newly developed ALD precursors. At the initial stage, ALD precursors are often extremely expensive (\$1,000/gm is not unusual) and are available in very small quantities. You can also benefit from the many mature high-productivity ALD processes that include HfO<sub>2</sub>, ZrO<sub>2</sub>, Ta<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, <300 °C TiN, BN, GaN, Nb<sub>3</sub>N<sub>5</sub> and more, available as turn-key processes from Sundew. Covering challenging patterned substrates such as advanced-generation DRAM device wafers, membranes, sensors, electron multipliers, etc. with up to 1,000 X enhanced area.

**Configuration:** The developer is available in 3 wafer size configurations and a fourth configuration for general parts and/or panels up to 300x300x10 mm. All configurations can be retrofitted in the field with flexible field-upgradeable options.

**ALD Manifold:** The Developer incorporates our standard millisecond response ALD manifold that integrates 10 of our patented Fast Pneumatic Valves (FPV) to deliver over 100 million trouble-free cycles of composite and nano-laminated ALD films. This manifold is the only ALD manifold that can switch composition every cycle without any throughput penalty. Field proven since 2005, our FPV valves set the records for speed, reliability, lifetime and safety, all while performing at temperatures as high as 220 °C. Sundew's ALD valves are the only doubly contained, spill-free UHP valves on the market.

**Sources:** Effective and well-controlled vapor delivery from proprietary, innovative gas, liquid and solid sources, as well as liquid injection of liquefied or solvated precursors and pressure controlled ozone are available on all Developer systems. Additional proprietary and innovative on-demand

sources are used for safely control and delivery of otherwise short-lived or exceedingly reactive reactants.

## Features and Benefits

- High throughput: 12-30 nm/min
- Low maintenance exceeding 50 micron of accumulated film MTBM
- Low consumables cost- up to 90% precursor utilization efficiency
- Flexible, field-upgradeable and scalable system configuration
- Fully interlocked for fault-safe operation
- Better than 1% WIW and WTW uniformity
- Proprietary ALD Valves with <1 msec speed, >100 millions cycle lifetime. Guaranteed chemical spill protected, doubly contained for unmatched safety
- Integrated ALD valves manifold for composite films deposition with no throughput penalty
- Adequate safe storage of flammable chemicals in a double-walled flammable cabinet (3 positions- standard, more positions- optional)
- Fully integrated, unlimited number of chemical sources and chemical delivery lines for volatile and non-volatile precursors
- Industrial PLC control with production-environment reliability and safety
- User friendly, flexible GUI
- Exhaust abatement
- Optional zero-waste module
- Optional load-lock
- Optional Integrated QCM for real-time film growth monitoring
- Optional remote plasma source

## Configuration:

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### Max substrate size (mm):

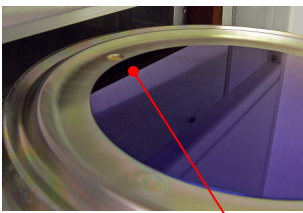
100 = 100  
150 = 150  
200 = 200  
300 = 300

### Substrate shape:

Null = Any  
W = wafers and any other substrates that fit within the wafer size and are up to 5 mm tall

Specifications	
<b>Maximum Substrate Size (mm):</b>	
D100-W (diameter)	100
D150-W (diameter)	150
D200-W (diameter)	200
D300 (WxDxH)	300×300×10
Number of process chambers	1
Number of load-lock chambers	(Optional) 1
Load-lock chamber configuration	single wafer
Process temperature range	75-400 (higher optional)
ALD manifold maximum temperature	220 °C (310 °C optional)
Dimensions WxDxH (cm)	75×140×170
Weight (Kg)	575
Maximum No. of metal precursors	Unlimited
Maximum No. of nonmetal precursors	Unlimited
Maximum flow (sccm)	5,000
Base pressure (mTorr)	5
Control	NI cFP
User interface	GUI
Power requirements	3φ 208 AC 30A
Idle power (heaters on) (W)	6,000
Air Pressure (PSI)	80
Maximum air flow (CFM)	0.70

### In-Situ QCM for Film Growth Monitoring:



Wafer Chuck with QCM

A QCM sensor is integrated into the Developer chuck to facilitate quick and detailed research of ALD processes with better than 5% of a monolayer mass-resolution and 10 msec time-resolution.

This powerful popular option is used for ALD process optimization, as well as detailed mechanistic studies of the chemistry, kinetics and physics of the reaction steps, surface species time and temperature stability, and the reactivity and thermal stability of ALD precursors. Sundew's proprietary temperature stabilized sensor is also capable of monitoring surface cleaning processes, surface nitridation and oxidation, reduction of oxidized metal films into the pure metal, rate and kinetics of oxidation, densification, silicide formation, annealing effects, precursor sublimation rate, de-chlorination and more.

### Applications

- ALD process R&D
- Application and device R&D
- ALD precursors development
- High-K dielectrics
- MIM capacitors
- ALD-Cap
- Trench isolation
- Abrasion resistant coatings
- Barriers, seed and metallization
- Floating gate dielectrics
- GMAR gap dielectrics
- Tunneling devices
- Ferroelectrics devices
- Sensors
- MEMS and NEMS structural and sacrificial layers
- Etch stop layers
- Interface and adhesion layers
- Corrosion protection

