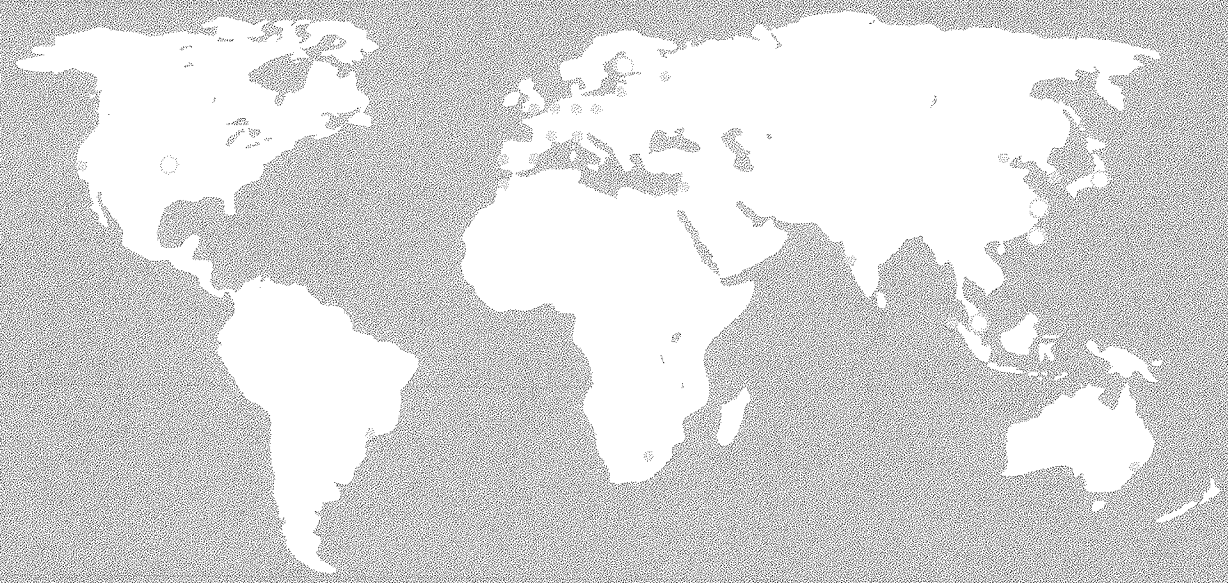

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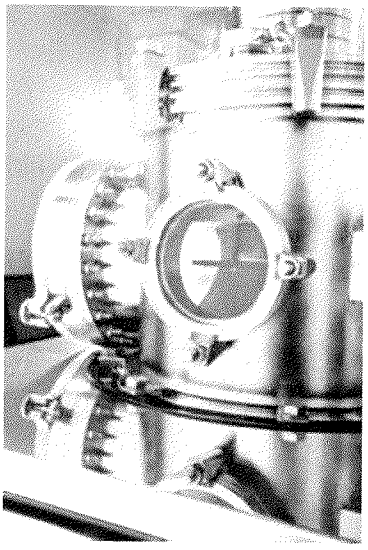

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Important Design Specs

IMPORTANT SPECS FOR THE TOOL AND PROCESS FUNCTIONALITY!!!

Four separate source lines and inlets with separate MFCs and PTs
- Prevents cross-contamination and reaction between different precursors before they enter the reaction chamber
- Innovative PT setup with SW comprises pulsing monitoring (easy start-up of new precursor)

Hot-wall reaction chamber
- The walls are at the same temperature as the substrate
- Prevents secondary reaction routes inside the reaction chamber that would result in the loss of self-limited growth mechanism of ALD
- Ensures the best particle performance and long maintenance cycles

Isolated reaction chamber mounted inside a vacuum chamber
- Metal-metal sealing surface and pressure control keeps all process gases inside the reaction chamber and no condensation occurs in the vacuum chamber walls
- Ensures that no corrosion occurs on the vacuum chamber walls
- No maintenance needed for the vacuum chamber
- Makes easy maintenance for the reaction chamber

Gas flow perpendicular to the substrate
- Enables uniform film deposition with challenging precursor chemistries
- Enables higher growth rate than tangential flow (cross-flow) reactor

Heated source for solid and liquid precursors
- Integrated particle filter for solid powders
- Replaceable cartridge for powder and liquids inside the source (no need to disassemble the source between different precursors)

Safety

IMPORTANT SPECS FOR SAFETY!!!

Reaction chamber mounted inside a cold-wall vacuum chamber
- Prevents possible injuries by burning hands or equipment on the hot reaction chamber lid
- Isolated reaction chamber ensures that all hazardous chemicals stay inside the reaction chamber and no condensation occurs on cold vacuum chamber walls

Automatic opening of the reaction chamber controlled with a touch panel
- No need to touch the reaction chamber lid when the reactor is heated

Software and hardware interlocks for hardware
- Software based pressure monitoring of the vacuum chamber with interlock limits
- Hardware interlock of the vacuum chamber over pressure
- Hardware interlock for overheating (touch safety: ~60 °C) of outer vacuum chamber wall
- Earthquake support legs of the reactor
- Emergency Off (EMO) buttons
- Hardware interlock of pneumatic lift crash

Software and hardware interlocks of hazardous chemicals
- Gas sensors to detect possible NH_3 and O_3 leaks
- Gas cabin for safe handling of high pressure gases and safe purging of gas lines
- TMA (trimethyl aluminium) cabin for pyrophoric chemicals
- Normally closed pneumatic valves (all valves closed if the pneumatic line burns)