

Chemical Vapor Deposition/ Infiltration of Advanced Materials

CVD 4000™

High-Volume Production System for Ceramic
Matrix Composites & Advanced Coating Materials



Work Zone:
42" ID & 50" H
(additional size available)



Thermal Processing
up to 1600 °C
Heating Rate >10 °C per min



Substrate Rotation for
Improved Deposition
Uniformity



Low Pressure
Operation



Five Zone
Temperature Control

CVD 4000™
Chemical Vapor
Deposition System

CVD 4000™ - Chemical Vapor Deposition System

The CVD 4000™ system supports a wide range of applications including industrial coatings, aerospace & defense, and nuclear. It has a large-scale industrial CVD reactor featuring a work zone with an internal diameter of up to 42 inches and a height up to 60 inches. The system is capable of operating at temperatures up to 1600 °C.

This system's furnace is comprised of 5 zones which are individually controllable and each have a power rating of 100 kW. The reactor can operate at controlled pressures from 50 Torr to 700 Torr, and is equipped with two pumps; one for initial chamber evacuation to base pressure, and one which is process-compatible.

The CVD 4000™ has a gas management system which is responsible for delivering gas and vapor to the reactor in a controllable and safe manner. The system is also equipped with optional dual endcap functionality for reduced time between process loads, and a shuttle system for payload transport.

Features and Options

- Five zone furnace with independent zone temperature control
- Temperature uniformity at $\pm 5^{\circ}\text{C}$
- Graphite retort & heating elements
- Heating ramp rate $>10^{\circ}\text{C}$ per min
- High rate of deposition for SiC coatings
- Substrate rotation for improved deposition uniformity
- Furnace cooldown in less than 12 hrs
- Stainless steel double wall, water cooled vacuum chamber
- Controllable rotation speed from 0.25 to 5 rpm
- Gas preheat & mixing zone
- Internal pyrolyzer
- Dual loading stations
- Shuttle cart

Technical Data

Work Zone	42" ID & 50" H (additional sizes available)
Power Supply	up to 500 kW
Operating Temperature	up to 1600 °C
Operating Pressure	50 to 700 Torr



Control Cabinets

- DC compartment with PLC control, PC and UPS
- Hardware interlocks for critical alarms (EMO)
- PLC software interlocks for other alarms
- AC compartment with VFD control for lift and shuttle motion and rotation

GMS Cabinets

- Engineered for safe handling of flammable and corrosive gases, liquids, and vapors
- Advanced mass flow controllers and meters for precise gas flow management
- Robust liquid flow controllers and meters for controlled liquid delivery
- Internal vaporizers and heated lines designed for safe, stable vapor precursor handling

Process Chamber

- Graphite felt insulation
- Bottom gas injection
- Top exhaust
- Exhaust gas heat exchanger
- Heated exhaust line and valves to prevent pyrophoric byproduct condensation
- Liquid ring process pump with non-process dry screw roughing pump process chamber



Loading Station with Shuttle Cart

Floor mounted track assembly to move endcaps through the CVD 4000™ system for payload transport from loading station, cooling station, and lift station into the reactor.

CVD
Equipment
Corporation

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