



Technical Specification of CVD Machines—HT2439

CVD/CVI Reactor for SiC, C and BN

The HT 2439 is designed for the CVD/CVI of silicon carbide and boron nitride. It has a rotating platform to permit the overall coating of parts weighing up to 300kg in a single cycle. A PLC control system runs the cycle without any operator intervention. The all carbon, working zone is suitable for operation up to 1,600oC at pressures between 1 and 1000mbar.



Overview

The CVD/CVI system HT 2439 has a graphite working chamber of 700 x 1000 mm high. This is surrounded by two independent resistance heaters controlled by thermocouples and two colour pyrometers. Thermal insulation is provided by ceramic fibre, all contained in a stainless steel vacuum vessel and water-jacketed. The main axis of the chamber is vertical and is accessed from the top.

The reactor is evacuated by a liquid ring pump plus two mechanical boosters. The booster pumps both have bypass valves so that a number of different pump combinations can be run.

It has a scrubbing utility that ensures a clean effluent gas.

The gas delivery system will handle six gas flows (CH₄, H₂, Ar, N₂, NH₃, BCl₃) and one gas from a liquid source evaporator for CH₃SiCl₃ (MTS). All gas flows have mass flow controllers. There are two feed lines to the reactor to permit delayed mixing of the reactants-necessary for BN.

The control system is supervised by a PLC microprocessor that will run complete cycles without the need for operator intervention. All process parameters are monitored and any variation outside of chosen limits initiates a safe shutdown procedure. The control system is usually installed remote from the rest of the machine for increased safety.

Specification

Criteria	Specification
Reactor Overall Dimensions	10 x 7 x 6m high+ height above for loading
Reactor Working Zone	700 diameter x 1000mm top loading
Temperature Range	900-1600°C
Temperature Measurement	2-colour pyrometer or thermocouple
Pressure Range	1-100mbar (standard control range)
Pressure Measurement	Absolute pressure transducer
Feed Gases	H ₂ , Ar, CH ₄ , NH ₃ , BCl ₃
Feed Liquids	SiCl ₄ , CH ₃ , SiCl ₃
Flow Control	Mass flow controllers
Vacuum Pumps	Liquid ring vacuum pump - 260m ³ /hr @ 50Hz Mechanical booster pump 1 - 1,220m ³ /hr @ 50Hz Mechanical booster pump 2 - 4,280m ³ /hr @ 50Hz Automatic pressure control by servo controlled line valve.
Materials of Construction	Vacuum vessel - 316 stainless steel Heater - graphite Reactor inner chamber - graphite Thermal insulation - ceramic or carbon fibre
Electricity	225KVA (3-phase)
Cooling Water	80litre/min
Compressed Air	100 p.s.i. small amount for actuators
Effluent Scrubber	Wet scrubbing column with 1,500L tank. Continuous pH monitoring & control.

CVD / CVI Processes

BCl₃ + NH₃ BN + HCl

CH₃SiCl₃ SiC + HCl

CH₄ C + H