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 1,600^{o}C 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 (CH_4, H_2, Ar, N_2, NH_3, BCl_3) and one gas from a liquid source evaporator for CH_3SiCl_3 (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.

QAS INTERNATIONAL
ISO 9001:2008
REGISTERED FIRM

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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

$BCl_3 + NH_3 \rightarrow BN + HCl$

$CH_4 \rightarrow C + H$

$CH_3SiCl_3 \rightarrow SiC + HCl$

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