



Technical Specification of CVD Machines— HT1414

Laboratory Scale Reactor for CVD/CVI

The HT1414 is a CVD reactor suitable for SiC, C, TaC, B₁₃C₂, Si₃N₄, BN, and related materials. It is a top-loading reactor with a working zone 350 mm diameter by 350mm high. The all carbon, working zone is suitable for operation up to 2,200°C at pressures between 1 and 1000mbar. The work assembly is carried on a rotating platform.



Overview

The HT1414 is a complete system consisting of a stainless steel CVD reactor with an all-graphite reaction chamber and furnace, supporting steelwork, gas supply system, vacuum pumps and effluent scrubber, and control system.

The CVD reactor has two forms: (1) Maximum operating temperature 1600°C for SiC, C, TaC, B₁₃C₂, Si₃N₄, BN; (2) Maximum operating temperature 2200°C for BN and pyrolytic graphite in addition to those in (1). A pyrometer is used to control the temperature of the reactor. The process pressure is controlled automatically in the range 5-100 mbar.

The gas control system supplies up to 6 permanent gas flows and up to flows from a liquid source evaporator.

All gas flows have mass flow controllers. The reactive gases are controlled by air-actuated ball valves to avoid ignition sources in the gas control system and to ensure a fail-safe situation in the event of an electrical power failure.

A liquid ring pump, combined with a mechanical booster, is used to pump the reactor. The effluent from the pumps is passed to a wet scrubbing system, which uses an alkaline solution to absorb the acid by-products of the CVD process.

The control system is housed in a single cabinet, which can be placed remotely from the rest of the plant. All normal operations can be carried out by push-button operation from the front panel. The controls are interlocked for safety.

Specification

Criteria	Specification
Reactor overall dimensions:	2 x 1.5 x 2.5m(high)
Working zone:	350 diameter x 350mm top loading
Temperature range:	900-1600°C or 2,200°C
Temperature measurement:	5-type thermocouple or 2-colour pyrometer
Pressure range:	5-100 mbar (standard control range)
Pressure measurement:	Absolute pressure transducer
Feed gases:	H ₂ Ar, CH ₄ N ₂ , BCl ₃ , NH ₃
Feed liquids:	CH ₃ SiCl ₃ or SiCl ₄
Flow control:	Mass flow controllers
Vacuum pumps:	Liquid ring vacuum pump - 100m ³ /hr Mechanical booster pump - 560m ³ /hr Automatic pressure control by servo controlled line valve
Materials of Construction:	Vacuum vessel - 316 stainless steel Heater - graphite Reactor inner chamber - graphite Thermal insulation - carbon fibre
Electricity:	90 KVA (3-phase) 115KVA (2,200degC version)
Cooling water:	50 L/min (40°C MAX, 20°C or less preferred)
Gases:	Argon, hydrogen, methane Total flow 50 SLM max.
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Compressed air:	100 p.s.i. small amount for actuators
Overall space requirements:	5 x 3 x 4m high.

CVD/CVI processes which can be operated in the HT1414:

