ATV TECHNOLOGIE GMBH

Microelectronic equipment • development, manufacturing and sales

Semiconductor Process Furnaces
Multi-Purpose Fast Ramping Bench-Top
Space-Saving and Energy Efficient

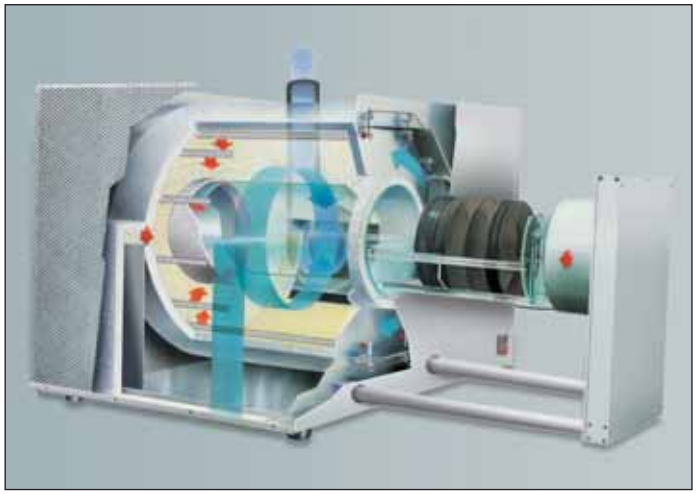
Features

- Temperatures up to 1150°C, ±0.2°C
- Fast ramping – Heats at 100°C/minute (max.)
- Fast cool down
- Quartz process chamber
- Up to 300mm diameter wafers or equivalent substrate size
- Vacuum down to 5 x 10-6 mbar/Torr
- Oxygen < 1 ppm
- Multiple process gases
- Pure hydrogen atmosphere (optional)
- Versatile – multiple processes with one furnace
- 100 steps per program
- Space saving and energy efficient

General Description

The PEO 600 Series furnaces are constructed to be space saving, energy-efficient units that can complete multiple tasks. Each is equipped with a quartz tube sealed by a bell jar mounted on a spring loaded tumbling plate on the door. This design ensures a leak-proof sealing when closed. Ball bearing shafts guide the manual opening and closing of the furnace door, which is locked during operation. An automated open/close door in an available option.

The furnace is heated by 12 Kanthal® resistor wire heaters suitable for temperatures up to 1450°C. Ceramic shafts, wrapped in Kanthal® wire form three individual programmable heating zones around the top, middle and bottom of the chamber. In addition, the oven contains one resistor wire disk heater in the door bell jar and a second one at the far end of the quartz tube, which can also be individually programmed.



This significantly increases the usable flat zone of the furnace. Temperature profiling with thermocouple substrates or TC wafers and fine tuning of each of the available five heater zones provides optial temperature uniformity for any process.

The thermal insulation around the chamber is rated for 1400°C operation. It is split into two halves with a slot on each side. Rapid temperature controlled cool-down is performed by a blower which draws room air through the slots cooling the outside of the quartz tube, heaters, and the thermal insulation. Maximum cool-down can be achieved in less than one hour from 1100°C to below 100°C. There is no cooling air flow during normal operation.

To protect quartz ware from becoming deformed, the maximum operating temperature is limited to 1150°C. Higher operating temperatures are available upon request with other materials.

The standard furnace is equipped with two programmable gas lines with manually adjustable flow meters. The standard plumbing is stainless steel with Swagelok® fittings. Addition gas lines, Mass Flow Controllers (MFC), gas panels, and VCR® fittings with orbital welded stainless steel piping are available options.

The air cooled PTFE(Telefon®) seals on the PEO-601 allow a He leak rate ~10^{-4} mbar l/s with a final maximum vacuum ~10^{-2} mbar and oxygen level is in the range of 10 ppm. Due to this and it's general design, the PEO-601 is not suitable for LPCVD and similar processes. This is the only limitation for the PEO-601.

The water-cooled Viton® seals on the PEO-603/612 and later models allows a He leak rate ~10^{-9} mbar l/s with a final vacuum < 5 x 10^{-6} mbar and oxygen level is in the range of 1ppm.

The processing method of loading the furnace at room temperature, ramping up, processing, and rapidly cooling down saves energy since there is no consumption during standby.

Control Software

Windows® -based software is available for easy programming and process recording. Select any digital or analogue parameter and the data will be recorded. Some elements of the program features are upper and lower process limits and alarms. Process records in ASCII format allowing SPC analysis. The software also features programmable operator access, bar code readers and other customer specific items.

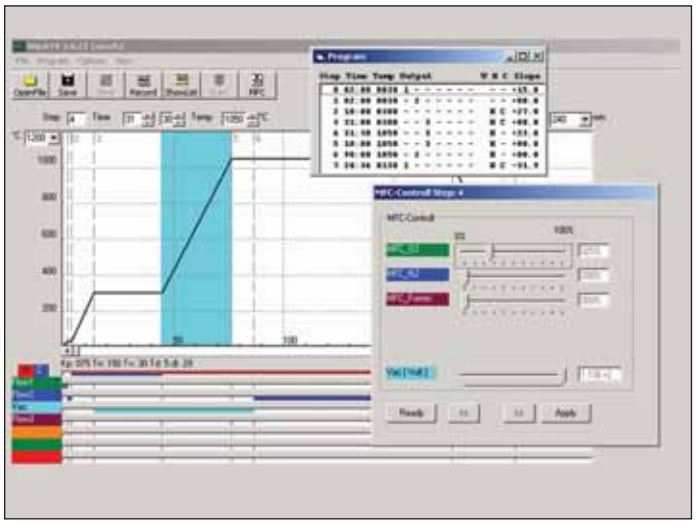
Programs can be easily created using either the mouse or key pad. Printed either as a graph or text.

Data is displayed in real time with zoom capability for more detail and can be printed as either graph or text.

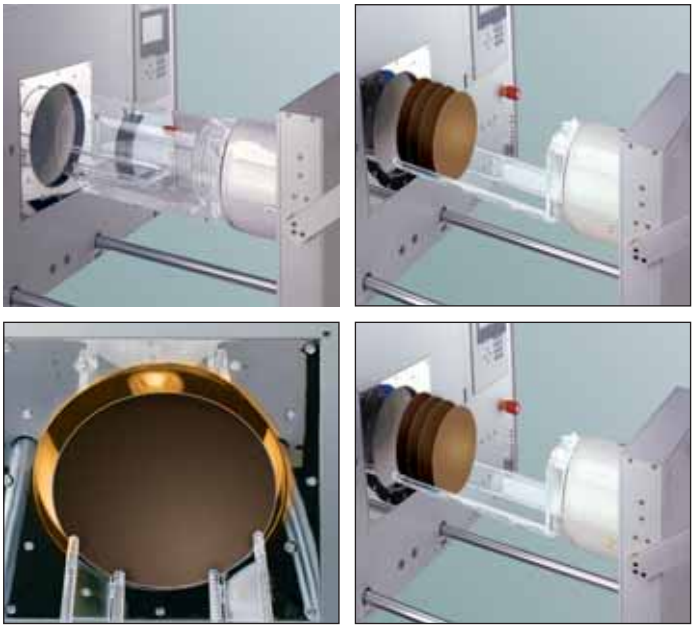
The standard furnace has a microprocessor based controller with digital outputs, 10 program locations of 100 steps each. Display and key pad are located on the front panel.

For enhanced processing capability a PLC with flat panel touch screen is available. Each program has up to 100 steps. An almost unlimited number of digital and analog outputs can be controlled and recorded for any device such as MFCs, etc. Enhanced safety features are now feasible and more temperature controlled heater zones are available.

Programs are easily created



Allprocess data in one view



LPCVD, diffusion, wet/dry thermal SiO_2, epitaxy, HCI-cleaning

Poly Si, $Si_3N_4$and SiO_2, LPCVD like other conflicting processes can be done in the same furnace, by using easy to replace quartz liners/reactor inserts. Evaporator systems for LPCVD, LTO and TEOS are available. For wet thermal SiO2, the furnace can be equipped with a low-cost bubbler, a DI water evaporator and a hydrogen torch system.
For diffusion with POCI3and BBr3, evaporator systems are available too. Diffusion with solid sources or spin-on coatings are standard features. HCI cleaning can be performed by either HCI gas, TRANS-LC or DCE.

Annealing under N_2, Ar, hydrogen, vacuum

For Pure hydrogen annealing, there is a hydrogen safety system available with automatic nitrogen purge before and after hydrogen flow with gas flow failure alarms. Vacuum annealing can be done down to max. 5 x 10^{-6}mbar. Inert gas annealing atmospheres can be achieved with a residual oxygen content of 1 ppm.

IR heating – single wafer/substrate RTA

For single wafer/substrate rapid thermal annealing, the furnaces can be equipped with IR quartz lamps achieving approximately 20°C per second. Other ramping rates are available upon request.

Uniformities

To meet customer specific temperature uniformity for a certain application, the furnaces will be temperature profiled with thermocouple wafers or thermocouple substrates. For wafer processes three thermocouple wafers of various diameters with five TCs each are used for profiling. The fine tuning of all five heater zones is performed by setting the off set parameters in the Windows based control software. Each process recipe has an individually programmable parameter set. Layer thickness can be verified also, which will be in the range of <3% for within wafer non-uniformity, < 5% for wafer to wafer non-uniformity.

Process support

At ATV we strive to meet the individual processing needs of our customers. We welcome customer input in developing new processes and customizing our equipment to each customer's unique requirements.

Low temperature processing

Polyimide curing, SiAu/SiAl.SiMo alloying, wet thermal oxidation on Al for VECSEL, low k dielectrics, post implanting annealing, wafer bump reflow, flux less reflow soldering, LTO, etc.
Program controlled low-temperature processing features programmable heater power with optimized control parameters for each program ensuring excellent temperature control at even low temperatures. By precise temperature control of the front, back, and side heaters, perfect temperature uniformity over the entire batch is achieved, even during ramp up/down providing uniform thermal treatment.
Processing under Nitrogen enriched (~1.5%) by low amounts of Formic Acid (HCOOH) provides shiny round solder balls and perfect solder joints by efficient Oxide removal prior to and during reflow.

Thick film paste – LTCC processing

Various quartz cassettes/carriers are available for horizontal substrate processing of any size. Gas preheating and gas flow in between the substrate ensures optimized process conditions for resistor paste firing. For copper paste firing, low oxygen atmospheres are achievable. For constrained LTCC sintering, a furnace with programmable hydraulic press is available.

Technical Data




	PEO-601	PEO-603	PEO-604	PEO-612
Inner Quarz-tube Ø	112 mm (4-1/2")	230 mm (9")	230 mm (9")	336 mm (13-1/4")
Maximum Capacity • Wafer • Ceramic Substrates • Flate Zone	40 x 100 mm dia., 4.76 mm pitch 40 pieces 2" x 2" 10 pieces 4" x 4 ~ 15 wafers 100 mm dia.	60 x 200 mm dia., 4.76 mm pitch 400 pieces 2" x 2" 120 piecces 4" x 4" 50 wafers 200 mm dia.	60 x 200 mm dia., 4.76 mm pitch 400 pieces 2" x 2" 120 piecces 4" x 4" 50 wafers 200 mm dia.	30 x 300 mm dia., 10 mm pitch, 60 x 200 mm dia., 4.76 mm pitch accordingly 25 wafers 300 mm or 50 wafers 200 mm dia.
Standard Product temperature	1000° C Continuously	1000° C Continuously	1000° C Continuously	1000° C Continuously
Maximum Product temperature	1100° C Continuously	1100° C Continuously	1100° C Continuously Higher upon request	1100° C Continuously Higher upon request
Heating	6 heaters Kanthal® resistor wire wrapped around ceramic shafts, each 1kW 2 zones, easily to replace	12 heaters Kanthal® resistor wire wrapped around ceramic shafts, each 1.6 kW 3 zones, easily to replace plus one each disk heater in the door bell jar and at the far end of the tube	12 heaters Kanthal® resistor wire wrapped around ceramic shafts, each 1.6 kW easily to replace plus one each disk heater in the door bell jar and at the end of the tube, 5 zones	24 heaters Kanthal® resistor wire wrapped around ceramic shafts, each 1.6 kW easily to replace plus one each disk heater in the door bell jar and at the end of the tube, 5 zones
Processing of inflammable and poisoned gases	no	no	yes, process tube, thermal insulation and heaters are inside a sealed metal box with N2 purge capability, cooling air in/out is controlled by program and interlock controlled shutters	yes, process tube, thermal insulation and heaters are inside a sealed metal box with N2 purge capability, cooling air in/out is controlled by program and interlock controlled shutters
Low temperature processing	feasible	feasible	perfectly by reduced heater power with 24 heaters in series	perfectly by reduced heater power with 24 heaters in series
Faster ramp up/down	no/no	no/yes by rapid N2 cooling capability	yes, by double heater power and rapid N2 cooling capability	no/yes, by rapid N2 cooling capability
Vacuum capability	5 x 10^{-2} mbar Max	5 x 10^{-6} mbar Max	5 x 10^{-6} mbar Max	5 x 10^{-6} mbar Max
Power supply • Europa • Country Specific	3 phases, 230/400 VAC, 5 wires neutral ground, 16 A, max. 7 kW Please Specify	3 phases, 230/400 VAC, 5 wires neutral ground, 32 A, max. 21 kW Please Specific	3 phases, 400 VAC, 5 wires neutral ground, 32/63 A, 21/42 kW Please Specify	3 phases, 400 VAC, 5 wires neutral ground, 32/63 A, 21/42 kW Please Specify
Power consumption	< 20 %	< 20 %	< 20 %	< 20 %
Dimensions • Millimeters • Inches	710 x 650 x 460 28" W x 25" H x 18" D	1000 x 710 x 800 39" W x 28" H x 31" D	800 x 1900 x 1400 mm 31" W x 75" H x 55"D	1000 x 1900 x 1400 mm 39" W x 75" H x 55" D
Weight	~ 45 kg (100 lbs)	~ 270 kg (600 lbs)	~ 475 kg (1050 lbs)	~ 540 kg (1200 lbs)

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