



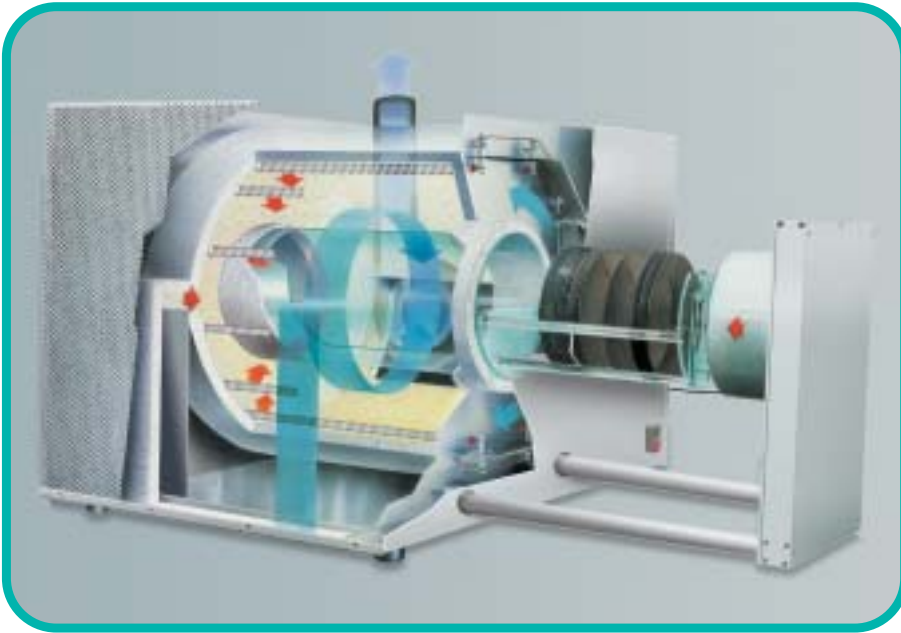
Semiconductor Process Furnaces Multi Purpose - Fast Ramping Bench Top Space Saving & Energy Efficient



- Temperatures up to 1150°C, +/- 0.2°C
- Fast ramping.
Heats at max. 100°C/minute
or 20°C per second
Cools down at 20°C/minute
- Quartz process chamber
- Up to 300 mm Ø 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 & energy efficient

PEO 601 - 603 - 612

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 is 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 3 individually 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 wafers and fine tuning of each of the available 5 heater zones provides optimal temperature uniformity for any process.

The thermal insulation around the chamber is rated for 1400°C operation. It is split into 2 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 the quartzware 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 2 programmable gas lines with manually adjustable flow meters. The standard plumbing is stainless steel with Swagelok® fittings. Additional gas lines, Mass Flow Controllers (MFC), gas panels, and VCR® fittings with orbital welded stainless steel piping are available options.

The air cooled PTFE (Teflon®) seals on the PEO-601 allow a He leak rate $\sim 10^{-4}$ mbar l/s with a final maximum vacuum $\sim 10^{-2}$ mbar and oxygen level is in the range of 10 ppm. Due to this and its 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 $\sim 10^{-9}$ mbar l/s with a final vacuum $< 5 \times 10^{-6}$ mbar and oxygen level is in the range of 1 ppm.

The small size of the PEO (approximately 1m x 1m x 1m) significantly saves floor space and makes stacking two furnaces possible.

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 feature 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.

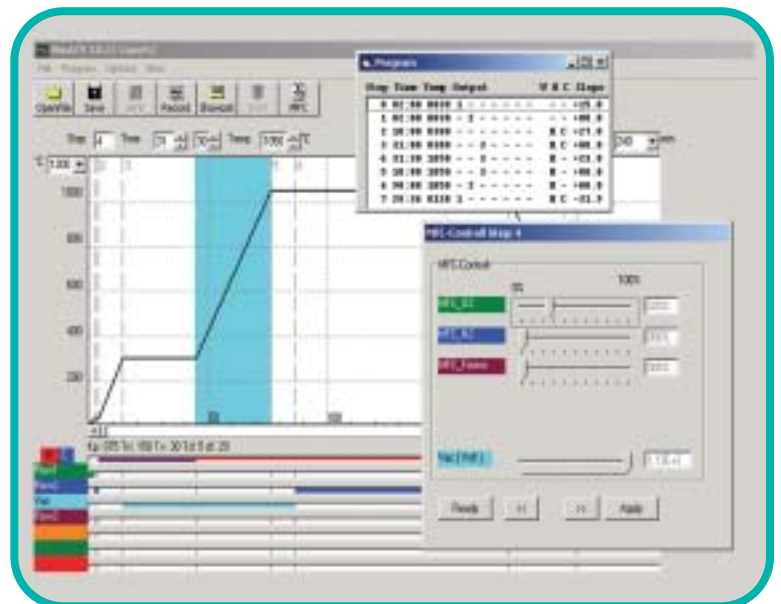


Control Software

The standard furnace has a micro processor 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 analogue 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 easily created



All process data in one view



OPERATION APPLICATIONS

LPCVD, diffusion, wet/dry thermal SiO₂, epitaxy, HCl -cleaning

Poly Si, Si₃N₄ and SiO₂, 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 furnaces can be equipped with a low cost bubbler, a DI water evaporator and a Hydrogen torch system.

For diffusion with POCl₃ and BBr₃, evaporator systems are available too. Diffusion with solid sources or spin on coatings are standard features. HCl cleaning can be performed by either HCl gas, TRANS-LC or DCE.

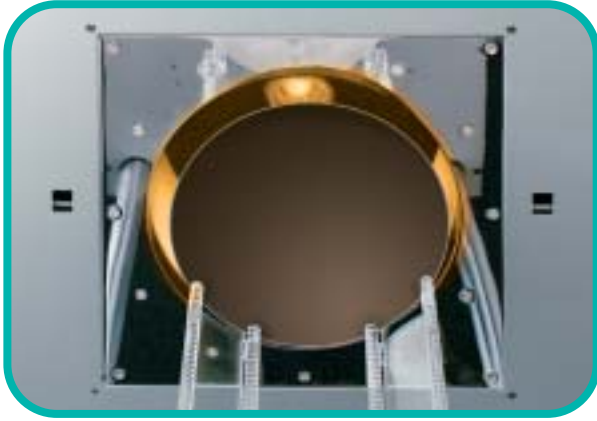


Annealing under N₂, Ar, Hydrogen, vacuum

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. It includes a flame off unit with 2 filaments and filament failure alarm. Vacuum annealing can be done in any vacuum down to max. 5×10^{-6} mbar. Inert gas annealing atmospheres can be achieved with a residual Oxygen content of 1 ppm.



OPERATION APPLICATIONS



IR heating – single wafer/substrate RTA

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

Uniformities

To meet customer specific temperature uniformity for a certain application the furnace will be temperature profiled with thermocouple wafers or thermocouple substrates. For wafer processes 3 thermocouple wafers of various diameters with 5 TCs each are used for profiling. The fine tuning of all 5 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 and < 5% batch to batch 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.

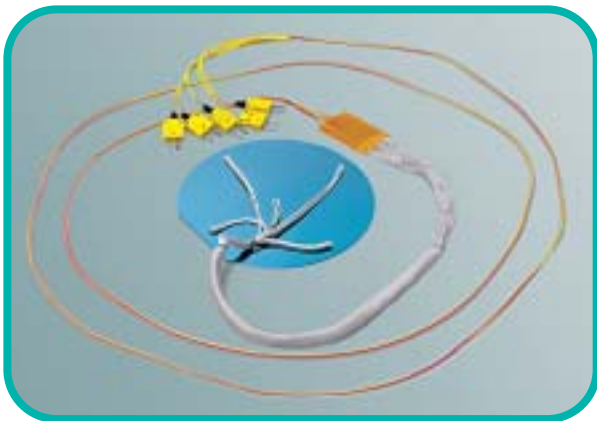


Low temperature processing

Polyimide curing, SiAu/SiAl/SiMo alloying, 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 optimised 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 achievable, even during ramp up/down providing uniform thermal treatment.

Nitrogen enriched atmosphere containing small amounts of Formic Acid (HCOOH) provides shiny round solder balls and perfect solder joints by efficient Oxide removal prior to 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 optimised 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

Quartz chamber: 112 mm (4 1/2") inner Ø
Max. Capacity: 40 wafers, 100 mm Ø, ceramic substrates: 40 pieces
2" x 2" or 20 pieces 4" x 4"
Standard temperature range: 1,000°C, continuously
Max. temperature: 1,150°C, continuously, higher upon request
Heating: 6 heaters, Kanthal® resistor wire wrapped around ceramic shafts, each 1 kW, 2 zones, easily to replace
Vacuum capability: max. 1 x 10⁻² mbar
Power supply EUROPE: 3 phases, 400 VAC, 5 wires, neutral, ground, 16 A, max. 7 kW
Power supply country specific: available, please specify prior ordering
Power consumption at 1,000°C: < 20%
Dimensions: 710 x 650 x 460 mm (28"W x 25"H x 18"D)
Weight: approx. 45 kg (100 lbs)



PEO-603

Quartz chamber: 230 mm (9") inner Ø
Max. Capacity: 60 wafers, 200 mm Ø, ceramic substrates: 400 pieces
2" x 2" or 120 pieces 4" x 4",
larger formats accordingly
Standard temperature range: 1,000°C, continuously
Max. temperature: 1,150°C, continuously, higher upon request
Heating: 12 heaters, resistor wire (Kanthal®) 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
Vacuum capability: max. 5 x 10⁻⁶ mbar
Power supply EUROPE: 3 phases, 400 VAC, 5 wires, neutral, ground, 32 A, max. 22 kW
Power supply country specific: available, please specify prior ordering
Power consumption at 1,000°C: < 20%
Dimensions: 1,000 x 710 x 800 mm (39"W x 28"H x 31"D)
Weight: approx. 110 kg (245 lbs)



PEO-612

Quartz chamber: 336 mm (13 1/4") inner Ø
Max. Capacity: 30 wafers 300 mm Ø, 60 wafers, 200 mm Ø, ceramic substrates: quantity based on size accordingly
Standard temperature range: 1,000°C, continuously
Max. temperature: 1,150°C, continuously, higher upon request
Heating: 12 heaters, resistor wire (Kanthal®) 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
Vacuum capability: max. 5 x 10⁻⁶ mbar
Power supply EUROPE: 3 phases, 400 VAC, 5 wires, neutral, ground, 32 A, max. 22 kW
Power supply country specific: available, please specify prior ordering
Power consumption at 1,000°C: < 20%
Dimensions: 1,200 x 850 x 900 mm (47"W x 33"H x 35"D)
Weight: approx. 140 kg (310 lbs)



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