

Tetra Arc Furnace for Crystal Growth

Manufactured by GES Corporation



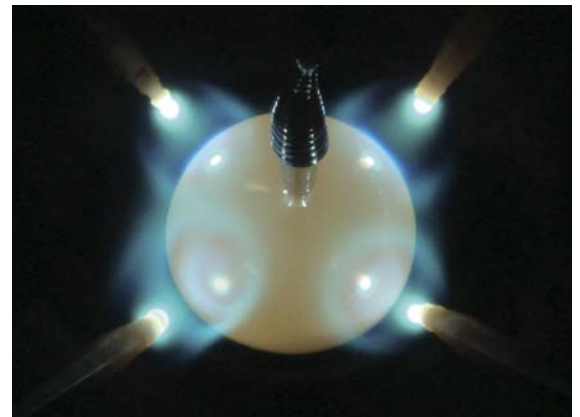
Features

- Single crystal growth by Czochralski pulling method
- Four electric arcs discharged in Ar gas to melt material up to 3000°C
- 10^{-6} Torr vacuum within one hour to achieve high Ar gas purity
- Convenient handling of material and furnace
- Easy operation from control panel
- Real time monitoring of crystallization process

Capable of growing

Metallic-conductive materials:

- Metal compounds
- High temperature superconductors

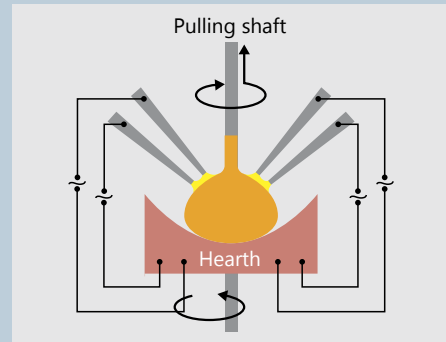


Single crystal of CeRh_2Si_2 (cerium, rhodium, silicon). Photo by GES

Special Features

System principle for crystal growth

- Material, on rotated hearth, melted by 4 electric arcs discharged in Ar gas
- Material pulled for gradual cooling for single crystallization by pulling shaft (Czochralski pulling method)



System composition

- Furnace unit
 - 4 arc electrodes
 - Pulling shaft
 - Hearth
 - Vacuum system
 - Ti getter
- Control unit
- Power supply unit
 - System control line
 - Arc generators



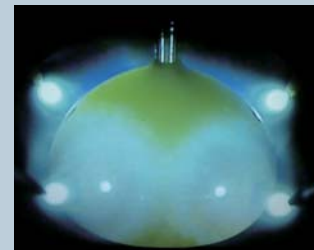
4 (Tetra) arcs

- 4x total arc power to melt material
- Uniform arc power by 4 arcs
- Easy control of arc power via control unit
- Direct manual control of arc position via arc electrode from outside of furnace



Real time monitoring

- Via CCD camera to check melting and pulling process to adjust arc power



Special Features

Convenient handling of furnace

- 4 monitoring windows (top / front / sides) of furnace
- Monitoring windows can open for sample placement and cleaning
- Top cover of furnace can be opened for easy maintenance and cleaning



Excellent vacuum system

- 10^{-6} Torr (within 1 hour)
- Turbo molecule pump (220L/sec) directly connected to large 4" gate valve of furnace to maximize conductance
- $< 1 \times 10^{-9}$ atm. cc/sec vacuum leak rate



TMP directly connected to 4" gate valve

Easy control via control unit

- Crystal growth parameters
 - Arc power control (each arc separately or all arcs at one time)
 - Hearth rotation
 - Pulling shaft rotation and pulling speed
- Vacuum pump control
- Malfunction alarm



4 arc power volume

Specifications

Furnace	Material and structure	Stainless steel (double walled + cooling water)
	Windows	Monitoring windows (top / front / side) open for sample placement and cleaning
	Working pressure range	5×10^{-6} Torr ~ 1.1Atm
	Vacuum discharge system	10^{-6} Torr (within 1 hour), turbo molecule pump : 220L/sec + rotary pump : 100L/min
	Vacuum gage	Measurement range : 760 Torr ~ 1×10^{-9} Torr
	Main valve	4" gate valve (manual)
	Arc electrode / shaft	4 tungsten electrodes / stainless shafts (water cooling)
	Getter electrode / shaft	1 tungsten electrode / stainless shaft (water cooling)
Pulling shaft	Material and seal	Stainless / ferro-fluidic seal+bellows (water cooling)
	Pulling speed	0-39mm/hr +/- 1.0% at full scale (servo-motor)
	Pulling stroke	150mm
	Rapid travel speed	100mm/min (fixed speed)
	Rotation speed	0-10rpm
Hearth	Hearth material	Oxygen free copper (water cooling)
	Shaft material and seal	Stainless / ferro-fluidic seal+bellows (water cooling)
	Rotation speed	0-10rpm
	Travel stroke	20mm (manual)
Control unit	Crystal growth parameters (arc power, hearth rotation, shaft pulling and rotation), vacuum control, malfunction alarms	
Power supply unit	System control lines, four arc generators (for four arc electrodes), getter generator, transformer	
Monitor	Real time crystal growing monitor via CCD	
Size (W x D x H)	Furnace unit: 1400 x 750 x 1200 (mm) Control unit: 600 x 550 x 1000 (mm) Power supply unit: 1400 x 750 x 1200 (mm)	
Weight	Furnace unit: 380kg Control unit: 120kg Power supply unit: 600kg	
Power requirement	190-460VAC 50-60Hz (20KVA), 3-phase, 4 wires + ground	
Cooling water requirement	15L/min, pressure 0.3~0.5MPa, temperature <25°C	