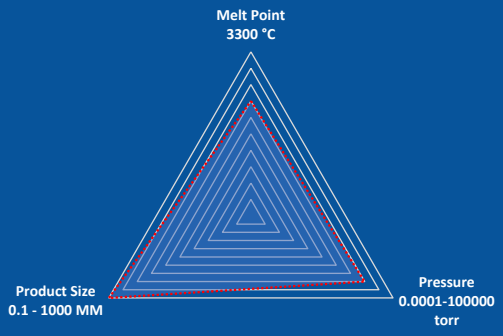

Cyberstar
an ECM Greentech brand
Crystal Growth Equipment
High Temperature Reactors
Gamma & X-ray Detectors

HISTORY

Cyberstar is a multidisciplinary technological equipment producer created in 1986 by Dr. F. Lissalde and B. Delagenière. Its products are rigorously made according to specific standards suitable for technological challenges encountered in research and high end industry.

Cyberstar has three main fields of excellence: high temperature furnaces, crystal growth equipment, x- and gamma ray detectors and related electronics.



Since the beginning, Cyberstar has been designing and manufacturing reliable and cost effective crystal growth equipment like Czochralski, Bridgman, floating zone, liquid phase epitaxy and, mirror furnaces (infrared or laser heating). These machines are fully computerized for an optimum control of the process giving a maximum yield and requiring minimum supervision. A unique and powerful automatic diameter control is included in the control software of our Czochralski pullers (Oxypullers).

Cyberstar also markets some of the building elements of its standard crystal growth machines like translation units, rotation units, chambers, and pulling heads. With these elements, it is very easy to build a customized growth station or improve an existing machine.

- More than 30 years experience in the production of small to midsize high temperature equipment and crystal growth furnaces for research and high end industries
- Part of the ECM group since July 2017
- About 400 units installed worldwide: 1/3 in USA, 1/3 in Asia & 1/3 in Europe
- Customers are industrial companies and public/ private research laboratories

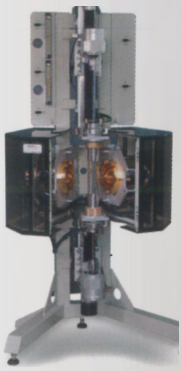
OVERVIEW

CZOCHRALSKI

- Various models from 2 to 100 kg capability
- Resistive or inductive heating
- Full automatic diameter control
- Various operating atmosphere from 10-5 mbar to 1.3 bar
- High pressure models available

FIBER GROWTH AND MISCELLANEOUS

Laser Heated Pedestal Growth (micro pulling down available)

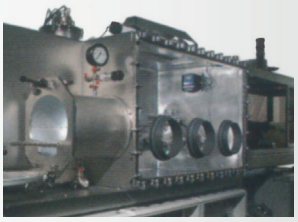


Infared-heated Mirror Furnace

Translation/rotation pulling mechanism, weighing device, growth software

CZOCHRALSKI PULLER

- Designed to produce various crystals of high quality and uniformity (Al_2O_3, BGO, $LiNbO_3$, $LiTaO_3$, YAG, YVO_4, GGG, LSO, Ge, InSb, $La_3Ga_5SiO_{14}$, etc)
- Crystal size up to 6”
- Various sizes up to 100 kg



HgCdTe liquid phase epilayer deposition

MIRROR FURNACE (HALOGEN, LASER HEATING)

- High temperature up to 2400°C
- Working gas pressure: max. 100 bars

KYROPOULOS FURNACE

- Designed to produce AL2O3 crystals up to 6”

BRIDGMAN FURNACE

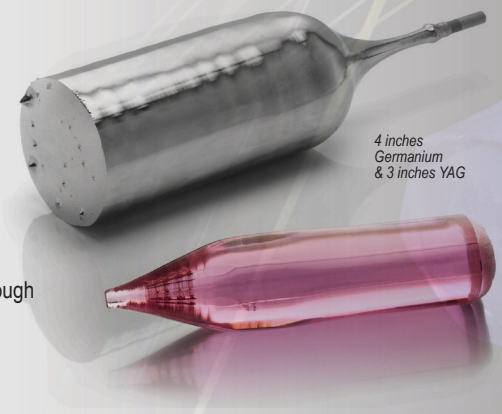
- Bridgman pullers for II-VI crystals, CaF_2 metals
- Crystal weight capability up to 250 kg

GRADIENT FREEZE FURNACE

- From 15kg up to 1500Kg furnaces of various capacities available for R&D or mass production
- Graphite resistor or induction heating

CRYSTAL GROWTH EQUIPMENT, MECHANISMS & PARTS

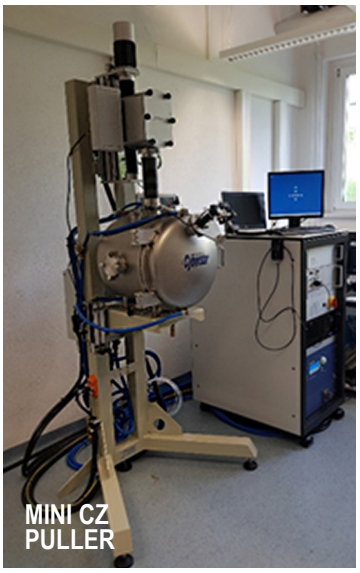
- Translation & rotation units
- Vacuum tight and water cooled chambers
- Magnetic rotating & teflon sliding/rotating seals
- Water cooled pulling rod
- Automatic feeding device
- HF glass to metal coaxial feed-through
- Stackable resistive elements
- Growth software for all systems



4 inches Germanium & 3 inches YAG

CZOCHRALSKI PULLER


LASER HEATED
PEDESTAL GROWTH


MINI CZ
PULLER


20-04
PULLER

CYBERSTAR offers a full range of very powerful Czochralski pullers with capabilities of producing up to 100kg single crystals under controlled partial pressures of oxygen and/or inert gas. These machines can produce various crystals of high quality and uniformity (Al_2O_3, BGO, $LiNbO_3$, $LiTaO_3$, YAG, YVO_4, GGG, LSO, Ge, InSb, $La_3Ga_5SiO_{14}$, fluorides, etc).

Fully computerized for optimum control, maximum yield and minimum supervision of the growth process, it can be continuously monitored in real time thanks to key parameters and target data. The process loop control is highly stable because of a meticulous electronic/mechanical design and original signal processing technique. These unique features help to produce well controlled growth of single crystals. Middle frequency Huttinger (10 kHz range) solid state power generators are used for maximum crucible life expectancy and reliability. The customer's thermal set-up, including insulation and crucible, fits inside a middle frequency induction coil. It is housed in a wide stainless steel, water cooled, double wall chamber of superior quality & functionality. Growth chambers can be proposed in many different sizes and/or topologies: vertical main axis front door opening, horizontal main axis front door opening, or vertical main axis top lid opening. Water cooled and equipped with quartz window view ports (one standard, more on request), they can be pumped down to 10^{-6} torr. We propose a clean turbo molecular vacuum station for optimum speed and efficiency. They can also be equipped with normal ball flow meters or more precise mass flow controllers. Stable and vibration free underframes can be equipped with dampers if necessary. Cyberstar machines are equipped with outstanding direct drive translation, rotation units and highly sensitive weighing devices. The quality of these elements makes them unique with specifications not matched by any of our competitors.

OXYPULLER CONTROL SOFTWARE

Oxypuller control software is exceptional among crystal growth machines, because it automatically controls the growth of the crystal starting from dipping, the very beginning of a growth run, until the crystal cooling. It includes an automatic diameter control using the derivative of the weight, and the set-point is computed in real time during growth from given parameters (shape and growth speed). In addition, the estimated growth rate and set-point are sent to a digital controller driving the middle frequency power generator. This software succeeds in controlling growth rates as fine as .01 g/h. As the level of the melt decreases during crystal growth, the crystal translation speed is continuously corrected in order to keep constant growth speed (mm/h). If a crucible lift system is installed, the crucible is moved up to adjust the solid liquid interface position inside the coil.

Versatile with its user-friendly Windows interface, it is designed to bring maximum interaction between the operator and the computer. The operator has full control, and can manually control the crystal growth at any stage and then return it to the full automatic control. Thanks to the auto-diagnosis/failure analysis module included in the software, every part of the equipment can be carefully tested. All parameters (crucible diameter, solid and liquid density, crystal shape, growth speed, rotation speed, cooling duration, etc...) needed to perform a crystal growth run are stored in a database. Acquired data during growth is also stored in the same database where it can be processed, displayed and printed by most popular spreadsheets.

Oxypuller 20-04 Industrial Puller
Single crystals up to 4-inch diameter & to 20 kg crystals (chamber topology vertical axis front door opening)

Oxypuller 05-03 Puller
Single crystals up to 2-inch diameter & to 5 kg crystals (chamber topology horizontal axis front door opening)

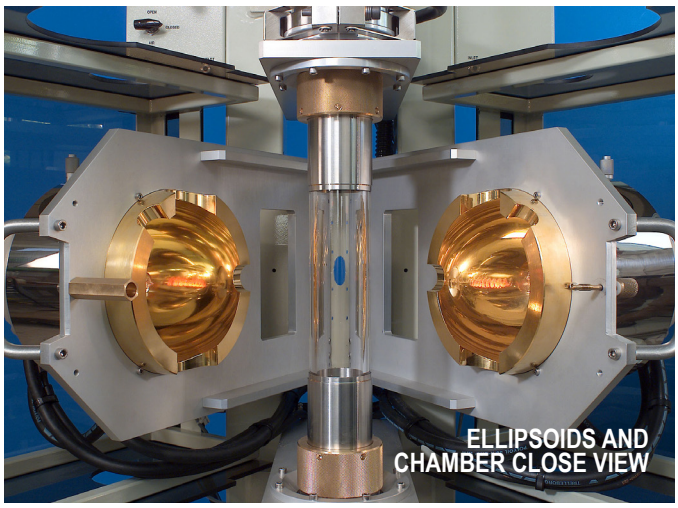
Oxypuller 20-05 Industrial Puller
Single crystals up to 6" dia. and 100 kg crystals (chamber topology: vertical axis front door opening)

Mini CZ Puller
Crystals up to 20mm diameter - ideal for research size crystals

High Pressure CZ Puller
Up to 20 kg single crystals under controlled high pressure, suitable for production of 111-V compound semiconductor crystals (e.g. GaAs, InP and InSb) by means of the high pressure liquid encapsulated (HPLEC) crystal growth method

MIRROR FURNACE

By means of mirrors to concentrate power coming from a radiating source, it is possible to reach, in a limited volume, very high temperatures. Furnaces using this technique are called mirror furnaces. Different geometries are possible. Cyberstar uses this furnace for the very popular conjugate ellipsoids topology. Radiation sources are placed on each of the independent focuses and light is concentrated at the common focus.


ELLIPSOIDS AND CHAMBER CLOSE VIEW


MIRROR FURNACE UP TO 100 BAR

As it can be seen on the overall picture, the machine is equipped with two translation mechanisms. The upper is set above ellipsoids and carry the isostatic pressed starting material. The lower is set below ellipsoids and moves the single crystal seed. In a typical growth run, a pendent droplet is made by moving the starting material down to the hot zone and the seed is moved up. When it touches the droplet and the thermal equilibrium is found, both translations are moved down synchronously at the crystallization speed like in the floating zone technique. It allows the growth of crystals without a crucible.

This machine is equipped with the outstanding Cyberstar translation and rotation units (building blocks).

- High temperature up to 3000°C
- Maximum operating gas pressure: 100 bars


UP TO 100 BARS

OPTICS

The combination of two lamps and two reflectors has been optimised by means of ray tracing simulations for a full efficiency of the furnace.

Reflectors consist of two ellipsoids made of an aluminium alloy polished and plated, by a layer of gold, for enhanced reflectivity and corrosion resistance. Heating sources are commercial low-price halogen lamps, or arc lamps, that are easy to replace. They are mounted on a stage allowing X-Y-Z translations and phi-theta rotations for fine tuning of the light concentration. The resulting molten volume of the sample is approximately 5mm long for a diameter of 5mm and temperatures as high as 2400°C can be reached with two 2 kW lamps.

CHAMBER

The sample is enclosed in a quartz tube, which extends through the ellipsoid mirrors assembly. The tube protects the reflective mirror walls from evaporating sample compounds and allows various types of atmospheres: vacuum, inert gas, reductive and oxidizing atmospheres.

The two sample rods enter the chamber through sealing devices creating a tight barrier to prevent gas leaks. The chamber can be pumped down to 10^{-4} Torr and work up to 10 bars (optional). For vacuum stations, see building blocks.

APPLICATIONS

This machine is perfectly suitable to grow at a low price (no crucible) any kind of crystals (oxide, fluoride, metallic alloys) for research or raw material testing.

BRIDGMAN FURNACE

For crystallizing various materials, Cadmium Telluride, II-VI compounds, CaF_2, Cyberstar can produce any kind of multi-heating elements Bridgman furnace with long “thermally flat” zones per customer specifications. With our technique it is possible to limit the number of independent controllers for a given temperature distribution. Up to an internal diameter of 500 mm, our building blocks are sufficiently versatile to fulfill almost any need with necessary adjustments.

For bigger furnaces we have the possibility to carry out numerical simulations, and can reduce the time needed for a new development. We can manufacture heating chambers of any size for crystals up to 200 kg. Frames are made of square welded steel tubes and are stable for vibrations free operation. Our machines are provided with integrated powerful elevators for lifting chambers and/or handling crucibles and crystals when necessary. All other elements are standard: translation units, rotation units, electronic control system, power stage, power feed through and heating elements.

Industrial four zones Bridgman vertical furnace (II - VI compounds)

Useful internal diameter:	80 mm
Ampoule total travelling length:	600 mm
Maximum temperature:	1300°C
Maximum gradient in the adiabatic zone:	10°C/cm

For monitoring a process, it is sometimes useful to measure temperatures around an ampoule or a crucible. Thermocouples hence are rotating. A standard method is to output their signals using rotating contacts; however, his technique is neither precise nor reliable. For this reason Cyberstar designed a more dependable contactless two channels thermocouples signal transmission. In case of special atmosphere, we can also propose a bichromatic pyrometer.

All our machines are controlled by PC computers with very flexible and user-friendly software. Any kind of translation, rotation, or temperature program can be made, especially if necessary; accelerated crucible rotation (sine, saw tooth, square) are proposed on request.

BUILDING BLOCKS

Cyberstar products are manufactured using a full set of building elements. This allows our company to tailor machines on request. It gives our customers the unique ability to assemble these elements on their own frame to make a new machine or to refurbish an old one.

CRYSTAL OR CRUCIBLE TRANSLATION UNIT

- Torque or torque mode motor
- Direct drive, no gears, no clutch
- Vibration free
- Only one motor gives access to the full speed range
- This unique configuration is very simple and leads to an outstanding reliability
- Travelling length: from 150 mm up to 1000 mm
- Crystal growth translation speed: +/- 0-100 mm/hour (0.01 mm/hour resolution)
- Fast translation speed: +/- 0-150 mm/minute (0.01 mm/minute resolution)
- Motor torque: up to 2.3 N.m
- High efficiency (theorical 0.9) re-circulating rollers or ball lead screws
- Lead screw pitch: 1 mm or 2 mm
- Lifting capability: up to 60 kg (single beam) and up to 250 kg (double beam)
- Absolute position transducer, resolution 0.01 mm, RS232 interface
- Electronic control unit:
  - automatic (computer controlled) or manual (operator)
  - resolution: 10^{-4} of the full scale
  - stability: 10^{-6} per °C of the room temperature variation

WEIGHING DEVICE

- Crystal or crucible weighing
- Weight sensor range from 5 to 100 kg
- Absolute sensitivity: 0.01 g (5 kg), 1 g (100 kg)
- Communication: RS232 interface

The weighing device is installed in a chamber machined out of a massive piece of aluminium for thermal homogeneity. It holds an adjustable mechanical safety feature to avoid overload. It is also designed to be vacuum tight when it is connected to the growth chamber through flexible bellows. This chamber is mounted vertically on the translation unit. The rotation motor is fixed under the weight sensor.

ROTATION UNIT

- For crystal or crucible
- Direct drive, no gears, no clutch
- Torque motor up to 2.3 Nm
- For very high torque up to 100 Nm continuous, brush-less motors and vibration free, high quality gear boxes are adopted
- High performance tachogenerator
- Oversized bearings
- Rotation speed: ± 0-100 rpm (maximum speed to be defined on request)
- Electronic unit:
  - resolution: 10^{-3} of the full scale
  - stability: 10^{-4} per °C of the room temperature variation
- Accelerated time dependant rotation sequences (ACRT): sin, square, saw tooth, etc.

Cyberstar also has 'Combination Systems' which can allow for 2 different growth processes. Such as Bridgman/CZ, CZ/Micro Pull-Down. Contact us to inquire about your application.

CONTACT US FOR DEMONSTRATIONS OR TEST RUNS IN OUR FACILITY

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