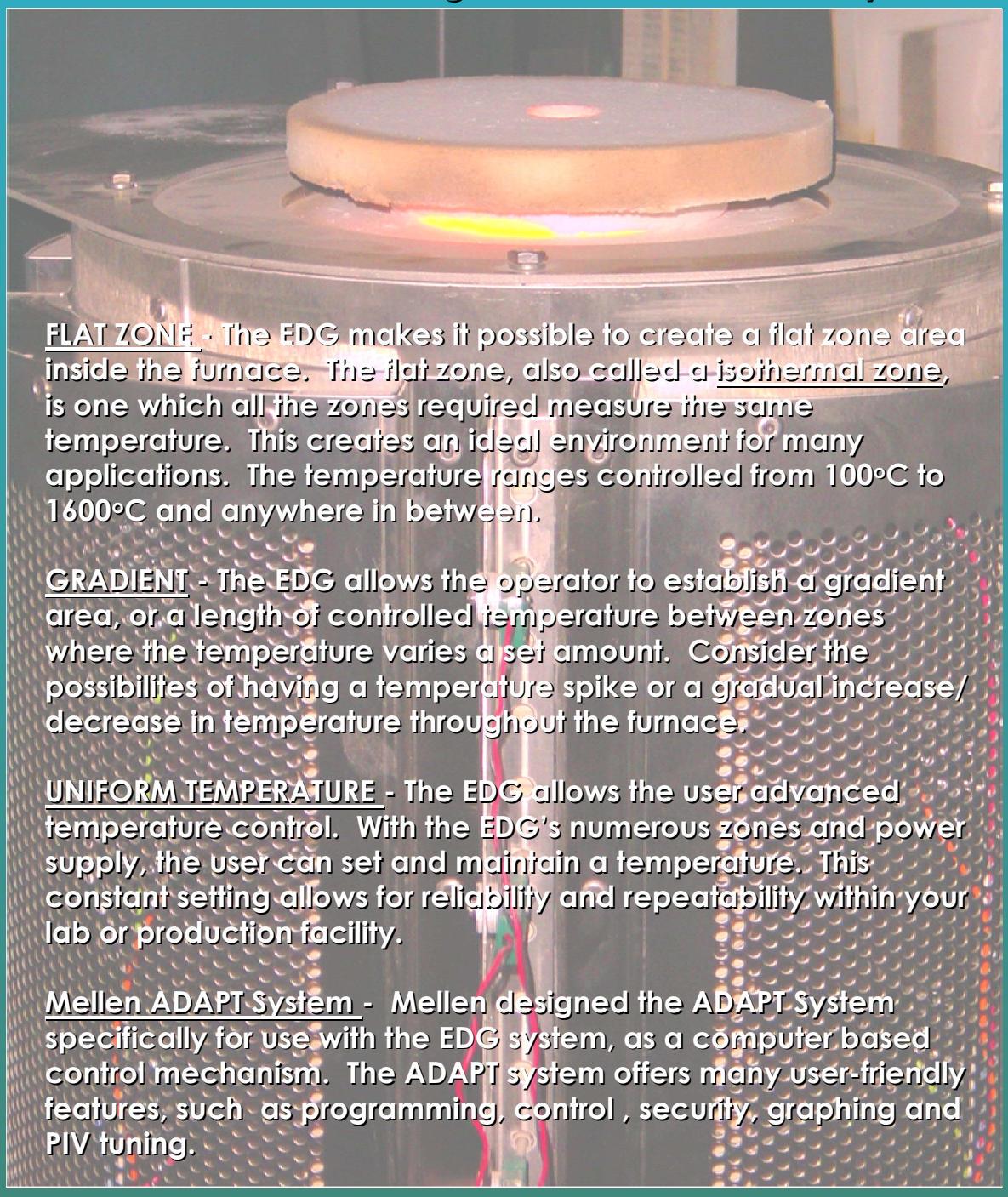
MELLEN

Furnaces Controls Motion Software Waterjet Cutting

What are the advantages of an EDG Sunfire System?



FLAT ZONE - The EDG makes it possible to create a flat zone area inside the furnace. The flat zone, also called a isothermal zone, is one which all the zones required measure the same temperature. This creates an ideal environment for many applications. The temperature ranges controlled from 100°C to 1600°C and anywhere in between.

GRADIENT - The EDG allows the operator to establish a gradient area, or a length of controlled temperature between zones where the temperature varies a set amount. Consider the possibilites of having a temperature spike or a gradual increase/ decrease in temperature throughout the furnace.

UNIFORM TEMPERATURE - The EDG allows the user advanced temperature control. With the EDG's numerous zones and power supply, the user can set and maintain a temperature. This constant setting allows for reliability and repeatability within your lab or production facility.

Mellen ADAPT System - Mellen designed the ADAPT System specifically for use with the EDG system, as a computer based control mechanism. The ADAPT system offers many user-friendly features, such as programming, control , security, graphing and PIV tuning.

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Inspired by the Crystal Growth Industry

The EDG Sunfire Furnace System continues in the research that led to the state-of-the-art crystal growth apparatus and equipment. Experiments have shown that the quality of compund semi-conductor crystals is directly related to the growth environment.

The MELLEN Gradient Freeze Method minimizes thermal stress and eliminates mechanical stress due to motion and vibration.

The Gradient Freeze Method could best be described as a combination of the Bridgman and the Linear Gradient Freeze Technique. The Mellen Gradient Freeze differs from the normal gradient freeze in five ways:

- The **span**, the **slope** and the maximum **temperature** of the work is controlled over the full length of the work with precision and repeatability.
- A flat zone across the ingot is established **before, during and after** gradient passage.
- **Computer Controlled linear movement** of the interface.
- **No moving parts**, no extraneous thermal currents.
- Utilizes **quadrant tuning**-localized or total.

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The Mellen method may be used both horizontally and vertically.

In the Mellen Gradient Freeze Technique, the furnace temperature profile is set up similar to the normal Bridgman profile approach.

From Here on the Resemblance to Traditional Processes Ceases...

Instead of moving the furnace or the work through the gradient, the **gradient is backed up** over the seed for "meltback" and then **electronically** moved forward over the melt. This results in solidification of a work charge.

This process allows the solid crystal material to remain in its own isothermal zone. At the same time, that leaves the other flat zone(the low temperature region) that generates the atmosphere in the ampoule, undisturbed.

Typical magnitudes of the gradient that can be easily handled by this method are

- **slopes** of 3-50°C per inch
- **Delta T's** of 6-150°C
- **speeds** of 0.25" per day to 2" per hour

The **shape of the moving gradient** and the **shape of the melt/crystal interface** may be controlled by the axial and radial tuning options.

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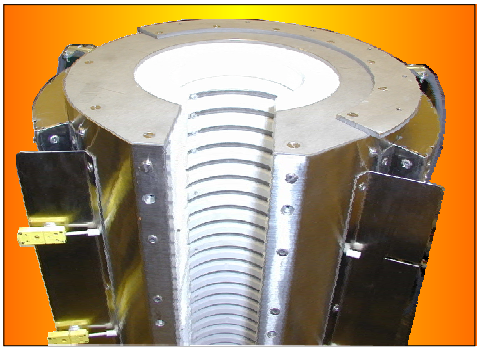
Three Dimensional Gradient Control for all Mellen Furnaces

Three-Dimensional temperature control is defined as the capability to affect the temperature characteristics along **the radial, azimuthal and longitudinal axes** of the furnace bore. Three-Dimensional temperature control permits tuning in three axes, either independently, or in conjunction with each other.

The Electro Dynamic Gradient Precision Furnace System lends itself to a wide variety of applications. Wherever the need exists for **precise applied gradients**, the EDG can be adapted.



Mellen EDG Omega Furnace

EDG Systems can be supplied with:

- split sections (our clamshell design)
- sight glasses
- quadrant tuning (localized heat transfer capability)
- EDG Sunfire System
- EDG Omega Furnace
- Gradient Control within +/- .25°C per inch
- Low Cost Multi-Zone Modular Furnace with EDG capabilities
- Mellen ADAPT System Software
- Accessories such as gradient enhancers, flat zone enhancers, Shielded Multi-TC Cable with Plugs, Stepper motor, floor stands, bench stands and temperature profilers (manual and automatic).

The EDG System is a precision tool for research as well as production.

MELLEN can raise your temperature in more ways than one, *the hotter, the better.*

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