

CAPABILITIES

Crystal Growth

High-quality, high-yield crystal production

With our extensive in-house crystal growth capabilities, we produce and deliver the highest quality optical materials you can buy. The choice of crystal growth method depends on the material and the desired properties.



Our crystal growth processes include:

Czochralski Growth

The **Czochralski technique** is widely used in the production of crystals for the semiconductor and laser industries. It is well-suited for the growth of many types of large oxide crystals, including **lithium niobate (/lithium-niobate)**. A furnace is used to melt the raw materials contained within a crucible. Although the temperatures are dependent on the material in production, conditions of over 2,000 degrees Fahrenheit are not uncommon. The crystal starts from a small seed, which is then slowly pulled upwards while rotating. The boule grows as the furnace temperature is

reduced, often with computer control of the temperature, rotation, and translation.

Top-Seeded Solution Growth

The **Top-Seeded Solution Growth** method facilitates production of crystals which cannot be grown directly from their own liquid phase. By use of a suitable flux, the desired material may be grown from a solution. The configuration of the equipment is often similar to Czochralski with modifications to the furnace. This is the preferred method for growth of large, high-quality **BBO crystal (/bbo)**.

Low Temperature Solution Growth

Materials which can be readily dissolved in water or an organic solvent at conditions near room temperature may be produced via **Low Temperature Solution Growth**. The standard

Horizontal Gradient Freeze

In the **Horizontal Gradient Freeze** method, the crystal is grown from a seed by slowly shifting the temperature gradient in a multi-zone furnace while leaving the crystal stationary. This allows the crystal to be grown with less mechanical vibration than methods where the crystal is translated through a furnace. In many cases the crystals are grown in sealed ampoules to contain the pressure generated upon heating the constituent materials. Transparent furnaces may be used to allow the seeding and growth to be visually monitored. Inrad Optics uses Horizontal Gradient Freeze to grow **ZGP crystals (/zgp)**.

configuration for this method places a seed crystal on a seed holder within a tank, all contained within a larger water bath. The tank is filled with the solution, the assembly is sealed to prevent evaporation, and the temperature of the water bath is then cooled at a controlled rate. With the proper equipment and optimized conditions, it is possible to grow extremely large crystals. Inrad Optics has experience growing a wide range of materials from low-temperature solutions. Current materials in production include **KD*P (/kdp-and-kd-p)** (grown in D₂O “heavy water”), **ultraviolet filter crystals (/uvc7)**, and the **organic crystal stilbene (/scintinel-stilbene)**.

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