

## Advertisement for Incubation of Technology

<b>Title of the technology</b>	<b>Single crystal growth of optical grade Semiconductor (Group IV) of 50 mm diameter and 150 mm length.</b>
--------------------------------	---

### Current state of Technology :

Complete process to grow semiconductor single crystal up to 50 mm diameter and 150 mm length with melting temperature up to 1450 C including growth process and hot zone design has been developed at CTS, TPD, PG.

### General Information:

Group IV semiconductor namely germanium and silicon are technologically one of the most important materials that are grown in single crystal form for various applications spanning from microelectronics to IR optics. These crystals are grown by Czochralski crystal growth technique employing either induction or resistive heating under inert ambient. We have developed the process to grow single crystal of germanium and silicon with purity >6 N and diameter around 50 mm.

Owing to its technological importance and unavailability of technology in India, it is proposed to commercialize this technology.

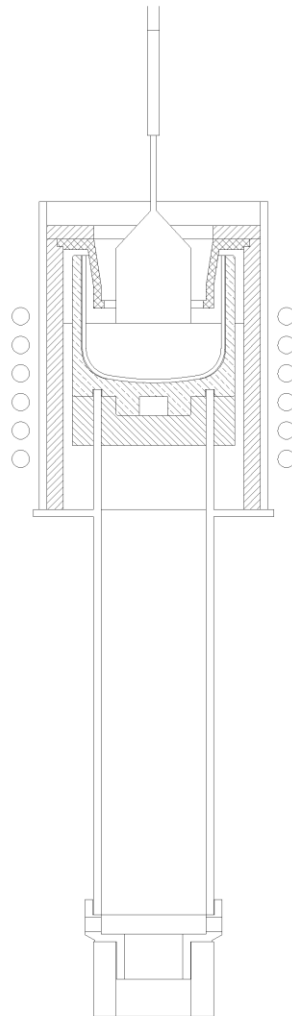
### Features/Specification of system

<b>Parameters</b>	<b>For Current System</b>	<b>For Target System</b>
<b>Material</b>	<b>Oxide</b>	<b>Semiconductor</b>
<b>Crystal Dia</b>	<b>25 mm</b>	<b>50 mm</b>
<b>Crystal length</b>	<b>75mm</b>	<b>100mm</b>

### Working of the System (with schematic block diagram)

In CZ technique crystals are grown by slow pulling of a seed/wire/ capillary from the free surface of a melt contained in a crucible. A growth station, to contain crucible and minimizes heat losses (by conduction and radiation), is made using appropriate ceramic tubes, felts, and wools. The material to be grown is melted in a crucible by heating it in a suitable furnace (resistive heating, RF heating, Arc heating, etc). A seed is lowered in to the melt, and then pulled (at a typical rate 0.2-25 mm/h) along with rotation (at a typical rate of 5-25 rpm) after achieving a dynamic equilibrium at the solid-melt interface. After the completion of the crystal growth with desired length and diameter, the process is terminated by suitably adjusting pull rate and temperature at the solid-melt interface. The grown crystal is then cooled down to room temperatures at a slow cooling rate suitable for the material. In normal conditions (if there is no stoichiometric

deviation due to decomposition and dissimilar evaporation of melt components), the melt temperature is nearly constant during the growth. The shape of the crystal can be determined by controlling the diameter of the growing crystal through the manipulation of the melt temperature and pull rate depending on properties of the material under consideration.



Hot Zone schematic for growth of silicon/Ge

**Applications of the System:**

Growth of optical grade Si/Ge of 50 mm diameter and 100 mm Length

**Picture/Photo of the System –**

**Whether the parent product/ technology/ process is patented: No**

**If yes, provide the details – NA**

**Deliverables –**

Optical grade single crystal of Si/Ge of 50 mm diameter and 100 mm length.

**Justification for Incubation –**

The existing technology to grow oxide crystal can be repurposed for growth of semiconductor (Si/Ge) single crystals having wider application.

**Facility and Infrastructure requirements:**

**Facility and Infrastructure to be provided by Incubatee/BARC:**

Manpower/ expertise 1 MSc (Preferably in Physics), 1Bsc (P,C,M,)
Machinery and Equipment 1. Czochralski Crystal Puller 2. Chemical fume hood to handle acids and chemicals used in material and crucible cleaning 3. Weigh scale (upto 5 kg)
Others The facility should be equipped restricted area with air showers to achieve cleanliness during crystal growth
Any special requirements for plant, industry, location utilities, handling storage, safety etc. Industry should have experience in the crystal growth or manufacturing of crystal growth related equipment

**Note: As per in-house technology incubation policy, the incubatee should be a licensee of the existing technology. Alternatively, the applicant will be required to take the license of the existing technology before entering incubation agreement.**

If interested in Incubation, kindly **download** -> **fill** -> **scan** -> **send** the scanned form to [incubation@barc.gov.in](mailto:incubation@barc.gov.in) and physical form to -

**CEO, AIC ANUSHAKTI  
R#115, DAE Convention Centre,  
Anushakti Nagar  
Mumbai - 400094**