Fig.1: Photograph of (a) Bridgman Crystal Growth Furnace at TPD, BARC. (b) Processed csI:Tl single crystal and (c) A typical radiation detector based on CsI single crystal.

Production and Fabrication of Single Crystals and Radiation Detectors

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Cesium Iodide doped with Thalium is one of the oldest scintillator single crystals which finds application in nuclear physics experiments to homeland security and medical diagnostics. This crystal is grown by Bridgman crystal growth technique. In the country this crystal and radiation detector consisting of this crystal is extensively used but till date this is imported. Keeping this in mind and the extensive use in DAE the technology to grow these single crystals and development of radiation detector was developed in TPD, BARC. A system to grow single crystals of CsI:Tl of size 50mm diameter and 75 mm length using Bridgman technique is developed in BARC (Fig.1a). The technology was perfected for the growth of CsI single crystal and growth parameters were optimized. Further processing of the grown crystal and coupling of the crystal to suitable photo-detector to fabricate radiation detector is developed (Fig.1(b) & (c)).

This technology has been transferred to M/s. Electronic Corporation of India, LTD Hyderabad (ECIL) and M/s Ants Systems, Thane in 2018 (Fig.2&3). M/s. ECIL has set up a single crystal growth lab in their premises at Hyderabad and growing CsI:Tl single crystals for commercial applications.

To have a commercial producer of CsI:Tl crystals in India and for development of customized radiation detector the technology was further transferred to M/s. Ace-ex Ltd Mumbai in 2022 and Incubation with the company has been started under Atal Incubation Centre, BARC, from December 2022.

Fig.2: Crystal Growth lab at ECIL.

In the similar note for the growth of oxide single crystals using the Czochralski technique the know-how for the production of oxide single crystals (Al_2O_3, $Y_3Al_5O_{12}$) of 25 mm diameter and 75 mm length was given to M/s. Raana Semiconductors, Hosur. The technology to grow the YAG and sapphire single crystals has been given so that commercial production of these crystals can be started in the country. In addition the technology to develop Czochralski Crystal growth Puller has also been shared under the technology transfer so that the company can develop the pullers indigenously with an aim towards 'Atma Nirbhar' Bharat in the field of Single Crystal growth for various applications.

Fig.3: Incubation Agreement signed with M/s. Ace Ex Pvt. Ltd., Mumbai on Dec. 22, 2022.

Technology Transfer agreement signed with M/s. ANTS.

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