

Single Crystal Technology in BARC

Present Status and Way Forward

Single crystals are often required to achieve full functionality of materials exploiting their properties. The design, discovery and growth of novel materials, especially in single crystal form, represent a core competency that is essential for the fulfilment of requirement of advanced scintillator materials and single crystals for radiation detection in power reactors and advanced accelerators. In this regard, the Crystal Technology Section (CTS) of Technical Physics Division (TPD) of Bhabha Atomic Research Centre (BARC) has been at the forefront in the country for several decades.

The CTS of TPD has been involved in the Single crystal growth and characterization of scintillator viz CsI:Tl, NaI:Tl, $Gd_3Ga_3Al_2O_{12}$:Ce, LaBr₃:Ce, LiI:Eu, SrI₂:Eu, Lu₂SiO₅:Ce, YAP:Ce, YAG:Ce, pure and doped Li₂B₄O₇ by Bridgman or Czochralski crystal growth technique. Further several nuclear radiation detectors and imaging devices which are useful in departmental activities have also been developed by us. These devices have been used for detection of (i) X-ray in the X-ray baggage scanner developed at BARC, (ii) electrons in SEM developed at BARC, (iii) very low dose gamma radiation in waste management plants (WIP and INKARP-BARC), (iv) detection and measurement of X-ray pulse in flash X-ray generators (APPD), and (v) neutron detection (Dhruva Beamline) and beam profile measurement in scynchrotron beamlines. The radiation detectors developed by our crystal growth team have been supplied to various laboratories in BARC as well as to other institutions within the country. These developments are in line with the DAE's effort in pursuit of the mission 'Atmanirbhar Bharat' (indigenization). The technology of crystal growth and device fabrication has also been transferred to Indian industries by BARC'S technology transfer unit and the incubation centre to have development of technologically important materials and machines in India.

In an attempt to chalk out the road map for Amrit Kaal period i.e. 2047 for the single crystal growth activity in DAE, a Chintan Baithak was held on 22nd Aug 2023 in BARC. A comprehensive plan to enhance these activities and how to have a complete supply chain of these devices in the country was presented. This thematic BARC Newsletter is yet another step in this direction to bring out the full spectrum of these developments. The Newsletter is quite timely as the use of nuclear radiation involving nuclear detectors as medical diagnostic tools as well as for cancer therapy are in growing demand.

We are grateful to SIRD for giving us this opportunity to bring out this issue compiling the achievements of our team members at CTS, TPD. I am sure that the readers would enjoy the range of articles on crystals and detectors chronicled in this issue.

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