Growth of CdZnTe Crystals for Radiation Detector Applications by Directional Solidification

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Advances in Cadmium Zinc Telluride ($Cd_{1-x}Zn_xTe$) growth techniques are needed for the production of large-scale arrays of gamma and x-ray astronomy. The research objective is to develop crystal growth recipes and techniques to obtain large, high quality CdZnTe single crystal with reduced defects, such as charge trapping, twinning, and tellurium precipitates, which degrade the performance of CdZnTe and, at the same time, to increase the yield of usable material from the CdZnTe ingot.

A low gravity material experiment, "Crystal Growth of Ternary Compound Semiconductors in Low Gravity Environment", will be performed in the Material Science Research Rack (MSRR) on International Space Station (ISS). One section of the flight experiment is the melt growth of CdZnTe ternary compounds. This talk will focus on the ground-based studies on the growth of $Cd_{0.80}Zn_{0.20}Te$ crystals for radiation detector applications by directional solidification.

In this investigation, we have improved the properties that are most critical for the detector applications (electrical properties and crystalline quality):

a) Electrical resistivity: use high purity starting materials (with reproducible impurity levels) and controlled Cd over pressure during growth to reproducibly balance the impurity levels and Cd vacancy concentration
b) Crystalline quality: use ultra-clean growth ampoule (no wetting after growth), optimized thermal profile and ampoule design, as well as a technique for supercool reduction to growth large single crystal with high crystalline quality.

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