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Crystal Growth, Characterization and Testing of $Cd_{1-x}Zn_xTe$ ($0.1 \leq x \leq 0.2$) Single Crystals for Radiation Detectors

Krishna C. Mandal[a], Caleb Noblitt[a], Michael Choi[a], R. David Rauh[a], Utpal N. Roy[b], Michael Groza[b] Arnold. Burger[b], David E. Holcomb[c] and Gerald E. Jellison[c]

[a]EIC Laboratories, Inc., 111 Downey Street, Norwood, MA 02062

[b]Department of Physics, Fisk University, Nashville, TN 37208

[c]Oak Ridge National Laboratory, Oak Ridge, TN 37831

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Krishna C. Mandal, Caleb Noblitt, Michael Choi, and R. David Rauh, EIC Laboratories, Inc., 111 Downey Street, Norwood, MA 02062

U.N. Roy, M. Groza and A. Burger, Department of Physics, Fisk University, Nashville, TN 37208

David E. Holcomb and Gerald E. Jellison, Oak Ridge National Laboratory, Oak Ridge, TN 37831

This paper describes our recent research in growing large single crystals of $Cd_{1-x}Zn_xTe$ ($0.1 \leq x \leq 0.2$) by vertical Bridgman technique using in-house processed zone refined precursor materials (Cd, Zn, and Te). The grown semi-insulating CZT crystals have shown high promise for room-temperature radiation detectors and detector arrays due to their high dark resistivity (~10^{10} Ω.cm), reasonably good charge transport properties [$\mu\tau_e$ = (2-5) x 10^{-3} cm^2/V] and low cost. The grown $Cd_{1-x}Zn_xTe$ ($0.1 \leq x \leq 0.2$) single crystals (~2.5 cm diameter and up to 10 cm long) have demonstrated very low radial Zn concentration deviation, low dislocation densities and Te precipitate/inclusions, and high infrared transmission. Details of the CZT single crystal growth, various surface processing and treatments, different steps involved in nuclear radiation detector fabrication and testing of these devices are also presented.