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Optical Microscopic and Spectroscopic Study of the High-Purity Germanium (HPGe) Single Crystals[1] JAYESH GOVANI, GANG YANG, GUOJIAN WANG, MUHAMMAD KHIZAR, Physics Department, The University of South Dakota, CHAOYANG JIANG, Chemistry Department, The University of South Dakota, DONGMING MEI, Physics Department, The University of South Dakota — High-purity germanium (HPGe) single crystals are required for the fabrication of radiation detectors. Before grown HPGe crystals can be effectively utilized, they need to be characterized for their purity, identification of impurities and dislocation density. These characterizations help to determine if the grown crystal is qualified for making detector and provide the feedback for crystal growth, so the crystals with the required qualities can be grown consistently. In the present study, we have performed optical microscopic analysis of the grown HPGe crystals. Our experimental results indicated that the crystals exhibit dislocation density in a range of 3000/cm^2 to 8000/cm^2 demonstrating that the dislocation density is within the required range ($\sim 10^2$ -10^4 dislocations/cm^2) to avoid the formation of undesired divacancy hydrogen (V_2H) complexes. Photo-thermal ionization spectroscopic (PTIS) analysis indicated that aluminum; boron and phosphorus are the dominant impurities in the grown crystals. We also performed the Van-der Pauw hall measurement for the determination of carrier concentration, resistivity and mobility of the charge carrier. In this paper, we show some characterization results from the grown crystals at USD.

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