Crystal Growth of Ternary Compound Semiconductors in Low Gravity Environment

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A low gravity material experiment will be performed in the Material Science Research Rack (MSRR) on International Space Station (ISS). There are two sections of the flight experiment: (I) crystal growth of ZnSe and related ternary compounds, such as ZnSeS and ZnSeTe, by physical vapor transport (PVT) and (II) melt growth of CdZnTe by directional solidification. The main objective of the project is to determine the relative contributions of gravity-driven fluid flows to the compositional distribution, incorporation of impurities and defects, and deviation from stoichiometry observed in the grown crystals as results of buoyancy-driven convection and growth interface fluctuations caused by irregular fluid-flows on Earth.

The investigation consists of extensive ground-based experimental and theoretical research efforts and concurrent flight experimentation. This talk will focus on the ground-based studies on the PVT crystal growth of ZnSe and related ternary compounds. The objectives of the ground-based studies are (1) obtain the experimental data and conduct the analyses required to define the optimum growth parameters for the flight experiments, (2) perfect various characterization techniques to establish the standard procedure for material characterization, (3) quantitatively establish the characteristics of the crystals grown on Earth as a basis for subsequent comparative evaluations of the crystals grown in a low-gravity environment and (4) develop theoretical and analytical methods required for such evaluations. ZnSe and related ternary compounds have been grown by vapor transport technique with real time in-situ non-invasive monitoring techniques. The grown crystals have been characterized extensively by various techniques to correlate the grown crystal properties with the growth conditions.

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