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Influence of Containment on the Growth of Germanium-Silicon in Microgravity

M. P. Volz[1], K. Mazuruk[2], A. Cröll[2,3], and T. Sorgenfrei[3]

1) NASA, Marshall Space Flight Center, EM31, Huntsville, AL 35812, USA

2) University of Alabama in Huntsville, Huntsville, AL 35762, USA

3) Kristallographie, University of Freiburg, Freiburg, Germany

A series of $Ge_{1-x}Si_x$ crystal growth experiments are planned to be conducted in the Low Gradient Furnace (LGF) onboard the International Space Station. The primary objective of the research is to determine the influence of containment on the processing-induced defects and impurity incorporation in germanium-silicon alloy crystals. A comparison will be made between crystals grown by the normal and "detached" Bridgman methods and the ground-based float zone technique. "Detached" or "dewetted" Bridgman growth is similar to regular Bridgman growth in that most of the melt is in contact with the crucible wall, but the crystal is separated from the wall by a small gap, typically of the order of 10-100 microns. A meniscus bridges this gap between the top of the crystal and the crucible wall. Theoretical models indicate that an important parameter governing detachment is the pressure differential across this meniscus. An experimental method has been developed to control this pressure differential in microgravity that does not require connection of the ampoule volume to external gases or changes in the temperature profile during growth. Experiments will be conducted with positive, negative or zero pressure differential across the meniscus. Characterization results of ground-based experiments, including etch pit density, synchrotron white beam X-ray topography and double axis X-ray diffraction will also be described.