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CRYSTAL GROWTH OF SI X GE 1-X USING THE BRIDGMAN TECHNIQUE: SI SEGREGATION AND INTERFACE SHAPE

Abstract

Silicon-Germanium single crystals play an important role in the electronic and optoelectronic industries. The SiGe phase diagram suggests that it suffers from strong segregation during the growth. Fluctuations in growth parameters are attributed to convection current occurring in the molten Si_xGe_{1-x}. In light of the large density difference between molten Si and Ge, gravity plays a central role in the inducement of convection flows in the molten alloy. This points out to the importance of performing SiGe crystal growth on a long duration microgravity platform to extract its fundamental properties. Toward the preparation of such experiments, crystal growth of Si_xGe_{1-x} with x = 0.25, and 0.15 was carried out using the Bridgman technique in the laboratory. The growth was performed in a three zone resistive furnace consisting of PtRh heating. The growth ampoules were translated at a speed of 5 mm/hr and 0.4 mm/hr where the temperature gradient was along the g vector. The grown SiGe samples were 2.5 cm diameter by 9 cm long. The samples were sliced axially, polished, and etched to study the evolution of the growth striations along the growth axis. The interface shape changed from concave to planar as the growth proceeds. Electron Microprobe Analysis was carried out to measure the Silicon composition along and transverse to the growth axis. The axial Si composition was analyzed using a simple one dimensional model assuming full mixing of the melt during growth and a segregation coefficient which varies with Silicon content in the melt.