III-V TERNARY BULK CRYSTAL GROWTH TECHNOLOGY

Partha Dutta

Department of Electrical, Computer and Systems Engineering
Center for Integrated Electronics
Rensselaer Polytechnic Institute, Troy, New York, USA
Address: CII-6015, 110 8th Street
City: Troy, NY
Zip Code: 12180
Country: USA
Phone: 518-276-8277
Fax: 518-276-8761
EMAIL: duttap@rpi.edu

Abstract

Semiconductor substrates with variable band gaps and lattice constants are key enablers for advanced electronic, optoelectronic, and photovoltaic devices. In spite of four decades of research on ternary substrates, the development of devices based on ternary lattice matched substrates have not been successful due to poor substrate quality of mixed alloys and/or low yield of wafers with same alloy composition [1-5]. Some of the recent advances made in the area of large diameter (50 mm or higher), compositionally homogeneous, bulk ternary crystal growth of GaInSb, AlInSb, GaInAs and GaInP will be presented [6,7]. One of the key parameters that dictate the crystal quality is the growth rate. For device grade substrates, the crystal growth rate has been found to be dependent on the alloy composition. Figure 1 shows the growth rate of GaInSb alloy system as a function of composition. For crystals grown at rates above the maximum growth rate have been found to be of poor quality. Similar studies have been performed for other III-V alloy systems and will be presented in this paper.

Figure 1. Maximum growth rate for vertical Bridgman grown micro-crack free Ga$_{1-x}$In$_x$Sb crystals as a function of alloy composition

References: