Development of large bandgap materials using reactive growth in Al-Si eutectic for optical and RF applications

N. B. Singh, Ching-Hua Su+, Puneet Gill, Fow-Sen Choa, Bradley Arnold, Brian Cullum, C. Cooper and K.D.Mandal
Department of Chemistry and Biochemistry, and Computer Science and Electrical Engineering
University of Maryland, Baltimore County, Baltimore, MD 21250
+ EM31, NASA Marshall Space Flight Center, Huntsville, AL 35812

ABSTRACT

Carbon was utilized as reactive element to modify the microstructure using forced mixing during crystallization of the Al-Si alloy by rotation and stirring. We nucleated the material on SiC substrates while the Al-Si melt was rotated with a speed of 30rpm in a graphite crucible. Several experiments were performed and parameters such as time of mixing, soaking temperature, rotation rate of the substrate and rate of cooling during the solidification was changed. We observed dendrite and cell morphologies during the solidification of rotating melt. The microstructure was characterized by optical microscopy and SEM-EDX and compositional spectroscopy. The effect of carbon impurities was studied on the solidifying microstructure. When we used the longer soak time of the melt in presence of carbon impurities we observed the destruction of dendritic morphology and the formation of cellular and colony structures. Similar approach has been used for Ga_2O_3, a novel large bandgap material also.