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Influence of substrate conductivity on layer thickness in LPE GaAs

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Abstract

Differences have been found on the growth rate of epitaxial layers grown simultaneously on semi-insulating and P and N type (1 0 0) GaAs substrates from the same Ga–As liquid solution. The layers were grown by LPE at 786°C using an initial supercooling of 15°C and a cooling rate of 0.5°C/min. The thickness of the grown layers was measured, under an optical microscope, in cleaved cross-sections etched in a $FeCl_3$–HCl solution. To fit the thickness-growth time data to the theoretical expression used for diffusion-limited growth it is necessary to use different initial supercoolings for the layers grown in each substrate, in spite that those layers were grown at the same time, from the same solution and therefore under exactly the same conditions.

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1. Introduction

Liquid phase epitaxy (LPE) is a very old and well-known technique used to grow semiconductor layers. The formula to calculate the thickness of the grown layers as function of the initial supercooling, growth time and cooling rate have been found long time ago [1] and tested for the validity of the approximations used in its deduction [2]. However, there are some well-known factors influencing the growth rate of a crystal. These have not been considered or have been neglected in the model used to deduce that formula. An example of such factors is the substrates orientation; it is a well-known fact that the growth rate of a crystal changes with the crystallographic orientation of the growing surface.

In this work we have found that the conductivity of the substrate has a non-negligible influence on the growth speed of an epitaxial layer.

2. Experimental procedure

A series of epitaxial layers were grown simultaneously and from the same liquid solution on

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