

THERMODYNAMIC ASPECTS OF ORGANOMETALLIC VPE TERNARY III-V EPITAXIAL SOLID SOLUTIONS

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Abstract. - Organometallic vapor phase epitaxy (OMVPE) is a new crystal growth technique which is rapidly gaining popularity due to its simplicity, flexibility and proven ability to grow excellent quality III/V compounds and alloys for device applications.

The fundamental aspects of OMVPE are only beginning to be understood. It is often classified as a "kinetically controlled" growth process. While this is true to some extent, thermodynamics play a major role overall. Two particular aspects of OMVPE growth of III/V ternary and quaternary alloys will be examined from a thermodynamic point of view :

1. Distribution coefficients in systems such as $\text{InAs}_{1-x}\text{Sb}_x$ and $\text{GaAs}_{1-x}\text{Sb}_x$ will be analyzed.
2. The occurrence of miscibility gaps in III/V systems, in particular observations and calculations of miscibility gaps in III/V alloys such as $\text{InP}_x\text{As}_y\text{Sb}_{1-x-y}$ and $\text{GaAs}_{1-x}\text{Sb}_x$ grown by OMVPE will be discussed.

In this paper experimental observations will be discussed in terms of calculations made using simple thermodynamic models of III/V solid alloys .

1. Introduction. - III-V ternary and quaternary compounds are key materials for the manufacture of heterojunction electronic and optoelectronic devices, because they make available in principle semiconductor materials with a wide range of band gaps. Most of these devices are made by growing on a binary thick substrate (several 100 μm) one or two epitaxial layers, the total thickness of which is smaller than 10 μm .