

Contents

1. Growth Effects in the Heteroepitaxy of III–V Compounds	1
<i>G. H. Olsen and M. Ettenberg</i>	
1. Introduction	1
2. The Crystal Structure and Growth of III–V Compounds	3
2.1. Crystallography of III–V Compounds	3
2.2. Vapor-Phase Epitaxy (VPE) Growth Technique	4
2.3. Liquid-Phase Epitaxy (LPE) Growth Technique	7
3. Elastic Strain Effects	9
3.1. Stresses in Heteroepitaxial Layers	9
3.2. Tetragonal Distortion	17
3.3. Coherency Limits in III–V Compounds	20
4. Dislocation Effects	23
4.1. VPE Materials	23
4.2. Dislocation Morphology in LPE Materials	39
5. Application to Device Structures: Transmission Photocathodes	45
6. Summary	48
Appendix A. Stresses in Heteroepitaxial Layers	49
Appendix B. Tetragonal Distortion in Cubic Crystals Strained in Two Dimensions	53
References	54
2. Aspects of Silicon Epitaxy	57
<i>J. Nishizawa</i>	
1. Mechanism of Vapor-Phase Epitaxial Growth of Silicon Crystals	58
1.1. Volume Reaction in the Vapor Phase	58
1.2. Surface Reaction in the Vapor Phase	59
1.3. Surface Migration	65
2. Perfect Crystal Growth from the Vapor Phase	77
2.1. Perfect Crystal Growth on Exact (111) or (100) Surfaces	77
2.2. Growth of Highly Pure Crystals. Abnormal Impurity Distribution at the Substrate–Deposit Interface	79
2.3. Effects in Silicon of Occluded Gas and Dissolved Material	84
3. Influence of Effective Lattice Misfit	87
3.1. Change of Lattice Constant by Impurity Doping	87
3.2. Compensation of Lattice Misfit	91

4. Device Applications: The Static Induction Transistor and Integrated Circuits	98
References	106
3. The Verneuil Process	109
<i>R. Falckenberg</i>	
1. Introduction	109
2. General Description of the Process	110
3. The Melt Film	116
3.1. Thickness and Shape	116
3.2. Effects in the Melt Film	118
4. Phenomenology of the Growth Process	124
4.1. Visual Observations	125
4.2. Model of Broadening	128
4.3. Starting Points for a Theory	130
5. The Cooling Process	131
5.1. Temperature Conditions during Cooling	132
5.2. Mechanisms Inducing Stress	134
5.3. Stress Determination	136
5.4. Plastic Deformation	140
5.5. Fracture	142
5.6. Remarks on the Cooling Process	143
6. Growth Parameters	144
6.1. Growth Chambers	144
6.2. Flame and Burner	153
6.3. Interaction between Flame, Growth Chamber, and Crystal	158
6.4. Powder Feeding	160
7. Redox Nature of the H ₂ /O ₂ Flame and Volatilization	170
8. Mechanical Strength and Annealing	172
9. Unusual Materials Grown by the Verneuil Method and Special Techniques	175
10. Concluding Remarks	179
References	180
4. Subsidiary Electrical Heating for Verneuil Furnaces in the USSR .	185
<i>C. H. L. Goodman</i>	
Index	189