

8.3.5	Methods of Grain Enhancement of a-Si/ μ c-Si Thin Films	343
8.3.6	Processing Considerations for TF-Si Solar Cell Fabrication	350
8.4	Conclusion	353
	References	354
9	High-Efficiency III-V Multijunction Solar Cells	359
	<i>J. M. Olson, D. J. Friedman and Sarah Kurtz</i>	
9.1	Introduction	359
9.2	Applications	363
9.2.1	Space Solar Cells	363
9.2.2	Terrestrial Energy Production	363
9.3	Physics of III-V Multijunction and Single-junction Solar Cells	363
9.3.1	Wavelength Dependence of Photon Conversion Efficiency	363
9.3.2	Theoretical Limits to Multijunction Efficiencies	364
9.3.3	Spectrum Splitting	364
9.4	Cell Configuration	365
9.4.1	Four-terminal	365
9.4.2	Three-terminal Voltage-matched Interconnections	366
9.4.3	Two-terminal Series-connected (Current Matched)	366
9.5	Computation of Series-Connected Device Performance	366
9.5.1	Overview	366
9.5.2	Top and Bottom Subcell QE and J_{SC}	367
9.5.3	Multijunction $J-V$ Curves	368
9.5.4	Efficiency versus Band Gap	370
9.5.5	Top-cell Thinning	372
9.5.6	Current-matching Effect on Fill Factor and V_{OC}	373
9.5.7	Spectral Effects	374
9.5.8	AR Coating Effects	375
9.5.9	Concentration	376
9.5.10	Temperature Dependence	380
9.6	Materials Issues Related to GaInP/GaAs/Ge Solar Cells	382
9.6.1	Overview	382
9.6.2	MOCVD	382
9.6.3	GaInP Solar Cells	383
9.6.4	GaAs Cells	393
9.6.5	Ge Cells	395
9.6.6	Tunnel-junction Interconnects	396
9.6.7	Chemical Etchants	397
9.6.8	Materials Availability	398
9.7	Troubleshooting	398
9.7.1	Characterization of Epilayers	398
9.7.2	Transmission Line Measurements	400
9.7.3	$I-V$ Measurements of Multijunction Cells	400
9.7.4	Evaluation of Morphological Defects	401
9.7.5	Device Diagnosis	401