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APPLICATION NOTE

III-V Multi-Junction PV - Application Discussion

III-V solar cell technology for concentrator PV systems is a technology that originally came from the triple junction III-V solar cells used in space applications where concentrators are not used. Cells for both applications, terrestrial concentrators and space, are designed to optimize conversion efficiency by collecting a broad range of the solar spectrum. Because the III-V alloy composition determines its energy band gap and many III-V alloys can be grown epitaxially on each other, a stack of multiple layers of different bandgaps can be manufactured.

The main area for improvement of III-V thin film PV is increased conversion efficiency for concentrator PV systems, and manufacturing scale up.

Materials characterization using surface analysis methods can be used to support analysis R&D of efficiency improvements.

The schematic of the III-V thin film PV device structure illustrates some of the ways surface analysis can help.

On the left side of the schematic we see the layered structure with the 'eV' value being the energy bandgap of that layer. This pictorial is for illustrative purposes only. The actual structures have many more layers. SIMS is especially useful to characterize the impurity profiles in these III-V stacks, but can also be used to evaluate the alloy composition profile (which is more often checked with XRD). The layer structure interfaces can be characterized by FIB/SEM and TEM. The metal contact can be characterized by XPS, XRD, and RBS. In manufacturing the contamination can be evaluated by FTIR, TOF-SIMS, XPS and GCMS.