Surface Structure, Interface Morphology, and RITD performance in the 6.1 Å Compound Semiconductors

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It is difficult to produce ideal interfaces in III-V heterostructures, yet ultimate device performance may require taking our best shot at controlling monolayer-scale roughness and compositional intermixing. Even when peak performance is not affected, run-to-run reproducibility can be improved through a better understanding of interface formation. Much of the challenge stems from the complex surface reconstructions of the III-Vs, particularly their non-unity stoichiometries. This issue is especially important for molecular beam epitaxy of the antimonides AlSb and GaSb, because several reconstruction stoichiometries exist over the range of substrate temperatures and beam fluxes that are typically used to grow these materials. We have investigated atomic-scale surface structure and RHEED as a function of growth conditions in order to better understand interface formation in the 6.1 Å materials. We have also observed that the performance of resonant interband tunneling diodes depends on growth conditions in a way that suggests a role for both roughness and intermixing. Investigation of the latter process has led to performance improvements through intentional alloying of the RITD barriers.