

Intrinsic and Extrinsic Effects on Performance Limitation of  
AlGaAs/GaAs Double-barrier Resonant Tunneling Structures

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Abstract

The performance limitations of negative differential resistance (NDR) in AlGaAs/GaAs double-barrier resonant tunneling structures (DBRTSs) have been investigated by varying the barrier thickness and quantum well (QW) width, and by doping In into the barrier layers. For devices with thick barriers ( $\sim 10$  nm), the scattering in the material is believed to cause the saturation of the peak-to-valley current ratio (PVCR). The dependence of PVCR on the well width, however, is found to be, to the first-order, not related to the scattering mechanisms or other material properties. It is rather an inherent property of the tunneling process under different conditions. On the other hand, it was found that a proper amount of In doping into the barrier layers can increase the PVCR, because of the lower defect concentration, resulting in lower scattering rate in the active region.