

Ultra-precise growth of tunnel barriers for low-cost devices

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While many prototype devices have been demonstrated that exploit tunnelling through thin barriers to achieve their superior performance, their commercial exploitation has been hampered by an inability to achieve reproducible current-voltage characteristics, both across one wafer and between wafers. The single AlAs barrier in an asymmetric doping environment in GaAs makes a very good microwave detector, but requires precision of barrier layers approaching 0.1 monolayer. Using a simple form of *ex-situ* calibration that allows fine tuning of MBE growth conditions, we have achieved I-V characteristics that vary by only $\pm 20\%$ about an absolute pre-specified value from wafers grown months apart. This only leaves the completion of a reverse engineering loop and the development of a right-first-time design methodology to achieve very low-cost tunnel devices for microwave and other applications.