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Effects of Pressure on GaAs/In_xGa_{1-x}As/AlAs Resonant Tunneling Structures

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The characteristics of GaAs/In_xGa_{1-x}As/AlAs double-barrier resonant tunneling structures (DBRTSs) subjected to pressure are discussed in this paper. DBRTS is grown by molecular beam epitaxy (MBE) on a [001]-oriented semi-insulating substrate, and the resonant tunneling structure (RTS) is processed successfully using an air-bridge structure and AuGe/Ni/Au metallization with a clear negative differential resistance (NDR) phenomenon. Because of the meso-piezoresistive effect of DBRTS, uniaxial, compressive stresses, which are determined by Raman spectroscopy, induce obvious I-V curve shifts: to more positive voltages (under stress along the [110] orientation) and to more negative voltages (under stress along the $[1\bar{1}0]$ orientation). The meso-piezoresistive sensitivities are approximately -1.51×10^{-9} Pa^{-1} (under [110] stress) and 3.03 $\times10^{-9}$ Pa^{-1} (under $[1\bar{1}0]$ stress), which are about one order higher than those of silicon. For the oscillator with RTS, the variety of its relaxation oscillation frequency (approximately –17.9 kHz/MPa) under stress is also presented and the mechanism is discussed.

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