Numerical optimization of Al-mole fractions and layer thicknesses in normally-on AlGaN-GaN double-channel high electron mobility transistors (DCHEMTs)

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Abstract: We explored the effects of the Al-mole fraction (x) of AlxGa1-xN barrier layers and the thickness of some layers on carrier densities and electron probability densities in normally-on AlGaN-GaN double-channel high electron mobility transistors. Investigations were carried out by solving non-linear Schrodinger-Poisson equations, self-consistently including polarization induced carriers that are important for GaN-based heterostructures and two-dimensional electron gas (2DEG) formation. Strain relaxation limits were also calculated, in which optimized cases were found for the investigated Al-mole fraction and thickness values under pseudomorphic limits. The effect of the investigated thickness changes on electron probability densities show no important change in the overall simulations. In addition to a carrier increase in the selected optimum cases, reasonable mobility behavior is also expected.

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