Study of the effects of the heterostructure physical parameters on the performance of HEMT devices

T.McMullen, M. Zervos, A. Adikimenakis, E. Iliopoulos, A. Georgakilas

Shallow barrier AlGaN/GaN HEMTs have been shown to produce high transconductances and current densities with gate lengths on the nanoscale. In this work we explore the electrical performance of a range of HEMTs grown by RF-MBE with the AlGaN barrier thickness varied between 7.5nm to 30nm with the AlN ratio compensated to the barrier thickness between 8-35%. Such heterostructure designs reveal high Hall mobilities (1850cm^2/Vs) at ambient temperature with a carrier concentration of 9.6×10^{12} cm^{-2}. The electrical performance of these heterostructures show, for a small barrier thickness and gate lengths of 1 micron, one can produce high transconductances (200mS/mm) and current densities (0.8A/mm) without the inclusion of a passivation layer.

Furthermore, analysis of the experimental Hall data and self-consistent Schrodinger-Poisson calculations suggest pinning of the Fermi level by the GaN cap layer.