Abstract

Tunnel FETs are a promising alternate to MOSFETs for low power design due to the ability to scale threshold voltage and hence supply voltage, without increase in OFF currents. However, they suffer from low ON currents. Demonstrated here is the enhancement in ION in arsenide–antimonide staggered-gap heterojunction (hetj) tunnel field-effect transistors (TFETs) by engineering the effective tunneling barrier height $E_{b eff}$. Moderate-stagger GaAs$_{0.4}$Sb$_{0.15}$.
6/In0.65Ga0.35As and high-stagger GaAs0.35Sb0.65/In0.7Ga0.3As heterojunction (hetj) TFETs are analyzed, and their electrical results are compared with the In0.7Ga0.3As homoj TFET. The GaAs0.4Sb0.6/In0.65Ga0.35Ashetj TFET achieves 134% enhancement in ION over the In0.7Ga0.3As homj TFET at VDS = 0.5 V. With electrical oxide thickness (Toxe) scaling from 2.3 to 2 nm, and using a high staggered hetero junction the enhancement further increases to 285%, resulting in a record high ION of 135 μA/μm.

References

- Mookerjea S. et al. Experimental demonstration of 100 nm channel length In0.53Ga0.47As-based vertical inter-band tunnel field effect transistors (TFET) for ultra low-power logic and SRMA applications. IEEE Int. Electron Devices Meet. 137. 1–137. 4, IEEE, 2009.
- D. Mohata . et. al Low-Temperature Atomic-Layer-Deposited High-k Dielectric for p-Channel In0:7Ga0:3As/GaAs0:35Sb0:65 Heterojunction Tunneling Field-Effect Transistor. Applied Physics Express 6 (2013) 101201
- R. M Wallace et al. &quot;Fermi level unpinning of GaSb using plasma enhanced atomic layer deposition&quot; Applied Physics Lett. 97
- R. Gandhi ,Z. Chen, N. Singh, K Banerjee and S Lee, &quot;Vertical Si nanowire n-type tunneling FETs with low subthreshold swing (