GATE INFLUENCED TUNNELING TRANSISTOR

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A transistor that employs the Quantum effect of tunneling as a main component of current is the ideal device for multi-valued logic. The first and only such device was fabricated by Seoul National University [1], which they called a Field Induced Band-to-Band Tunneling Effect Transistor (FIBTET). The device structure for a FIBTET is extremely similar to a FINFET. The main differences are degenerately doped source, drain, and body regions. This device exhibits an I-V characteristic resulting from a gate influenced region of negative differential resistance (NDR), and a region of negative differential transconductance (NDT). Quantum tunneling has better control and predictability as dimensions are shrunk to smaller and smaller sizes, resulting in better device performance.

The proposed device fabrication procedure, using SOI wafers, is as follows. A poly spacer process [2] will be used to form the fins. Through photolithography, the body region of the fin will be defined. The body is to be implanted to degenerate doping levels. Than, a third photolithography step will define the gate. Finally, the source/drain regions will be exposed, allowing for degenerate implantation. As part of the proposed fabrication process, preliminary etched profiles of the fins will be shown. Results pertaining to the feasibility of fabricating working FIBTET's at RIT will be presented.

[1] K. R. Kim, D. H. Kim, K. Song, G. Baek, H. H. Kim, J. I. Huh, J. D. Lee, and B. Park, "Silicon-Based Field-Induced Band-to-Band Tunneling Effect Transistor," IEEE ELECTRON DEVICE LETTERS, VOL. 25, NO. 6, JUNE 2004.

[2] S. Sung, Y. C., J. D. Lee, and B. Park, "Realization of Ultra-Fine Lines Using Sidewall Structures and Their Application to nMOSFETs," Journal of the Korean Physical Society, Vol. 35, December 1999, pp. S693_S696.