Germanium MOS: An Evaluation from Carrier Quantization and Tunneling Current

Tony Low, Y. T. Hou, M. F. Li, Chunxiang Zhu, D. -L. Kwong#, and Albert Chin*

Silicon Nano Device Lab, ECE Department, National University of Singapore, Singapore 119260.

Tel: 65-68742559, Fax: 65-67791103, Email: elelimf@nus.edu.sg

#Dept. Electrical and Computer Engineering, University of Texas at Austin, Austin, TX 78712, USA.

* ¹Dept. of Electronics Eng., National Chiao Tung Univ., Hsinchu, Taiwan

Abstract

An evaluation of Ge MOS from quantization and gate tunneling current simulations is reported. Electron quantization effect is stronger and thus more important in Ge than in Si, and results in smaller inversion capacitance in NMOS and considerably larger gate tunneling current. High-k gate dielectrics are required for low leakage; however, significant challenges exist in the formation of high quality interface layer between high-K and Ge. Using constant inversion charge for supply voltage $V_{DD}$ scaling, moderate reduction in inversion charge and enhancement in mobility is required to meet ITRS roadmap.