Evidence of Real-Space Transfer in Buried-Channel \( \text{Ge}_x\text{C}_{1-x} \) Devices

En-Shao Liu, Microelectronic Research Center, University of Texas at Austin, David Kelly, Texas Instruments, Joseph Donnelly, Emanuel Tutuc, Sanjay Banerjee, Microelectronic Research Center, University of Texas at Austin — We present experimental evidence of real-space transfer (RST) in buried-channel \( \text{Ge}_x\text{C}_{1-x} \) p-type metal-oxide-semiconductor field effect transistors (MOSFET) containing a Si cap layer. The output characteristics of these devices reveal a negative differential resistance (NDR) below 150K, at the onset of the saturation regime. This observation indicates a charge transfer from \( \text{Ge}_x\text{C}_{1-x} \) layer into the Si cap at sufficiently large drain bias values. The lower hole mobility of the Si cap with respect to the \( \text{Ge}_x\text{C}_{1-x} \) translates into a drain current reduction, hence the observed NDR. Our low-field, temperature-dependent mobility measurements indeed reveal a higher effective carrier mobility in the buried-channel \( \text{Ge}_x\text{C}_{1-x} \) layer with respect to a Si-reference sample, which suggests that the observed NDR is caused by RST of holes from the \( \text{Ge}_x\text{C}_{1-x} \) into the Si layer.

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