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High Performance Ge/Si Core/Shell Nanowire Transistors with High-k Dielectrics JIE XIANG, WEI LU, YUE WU, CHARLES LIEBER, Department of Chemistry and Chemical Biology, Harvard University — The growth of semiconductor heterostructures provides the opportunity to improve dramatically transport properties through band structure engineering. In particular, we have observed hole gas formation and confinement in the intrinsic germanium core of epitaxial Ge/Si core/shell nanowire heterostructures. In this talk, we demonstrate the integration of high-k dielectrics with high performance Ge/Si core/shell nanowire field effect transistors. The high-k dielectrics were deposited via atomic layer deposition process, followed by e-beam lithography of local top gates. With this technique, we have obtained a transconductance among the highest in semiconducting nanowire transistors. We have also investigated the transconductance and subthreshold slopes as a function of channel length and temperature to elucidate carrier screening inside the nanowire and oxide/nanowire interface properties. Prospects for integrated ballistic nanowire field-effect transistors will be discussed.

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