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Physics and Applications of Ge/Si Core/Shell Nanowires JIE XIANG, WEI LU, YONGJIE HU, YUE WU, HAO YAN, CHARLES LIEBER, Department of Chemistry and Division of Engineering and Applied Sciences, Harvard University — We recently reported hole-gas formation and ballistic transport through 1D modes in band-structure engineered Ge/Si core/shell nanowire heterostructures at cryogenic temperatures, opening up a new platform to study low-dimensional transport phenomena and applications such as high performance room temperature field effect transistors. In this talk we report studies of single Ge/Si nanowire field effect transistors employing high-k dielectrics with top gate geometry. The clean hole-gas system and enhanced gate coupling from the high-k dielectric allow clear identification of discrete 1D subbands, as well as the observation of superconductivity proximity effect with superconducting contacts. Room temperature FET characteristics exhibit the best performance achieved in nanowire FETs, and the calculated intrinsic delay as a function of gate length for these nanowire FETs shows a clear scaling advantage over planar Si MOSFETs. Studies investigating the effect of novel gate structures to control ambipolar behavior and threshold voltage will also be discussed.

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