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Realizing lateral wrap-gated nanowire FETs: Controlling gate length with chemistry rather than lithography ADAM MICOLICH, School of Physics, University of New South Wales, Sydney NSW 2052, Australia, KRISTIAN STORM, GUSTAV NYLUND, LARS SAMUELSON, Solid State Physics/Nanometer Structure Consortium, Lund University S-211 00 Lund, Sweden
— An important consideration in miniaturizing transistors is maximizing the coupling between the gate and the semiconductor channel. A semiconductor nanowire with a coaxial metal gate represents the optimum in gate-channel coupling, but has only been realized for vertically-oriented nanowire transistors. We report a method for producing laterally oriented fully wrap-gated nanowire field-effect transistors that provides exquisite control over the gate length via a single wet etch step, eliminating the need for additional lithography beyond that required to define the source/drain contacts and gate lead. Our design allows the contacts and nanowire segments extending beyond the wrap-gate to be controlled independently by biasing the doped substrate, significantly improving the sub-threshold electrical characteristics. Our devices provide stronger, more symmetric gating of the nanowire, operate at temperatures between 300 to 4 Kelvin, and offer new opportunities in applications ranging from studies of one-dimensional quantum transport through to chemical and biological sensing.

Adam Micolich
School of Physics, University of New South Wales,
Sydney NSW 2052, Australia

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