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Electrical characterization of surface passivation in III-V nanowires GREGORY HOLLOWAY, University of Waterloo, RAY LAPIERRE, McMaster University, JONATHAN BAUGH, University of Waterloo — III-V nanowires are promising for implementing many useful technologies including optical sensing and quantum information processing. However, most native nanowires have a significant density of surface states, which cause electron accumulation at the surface and make the optoelectronic characteristics very sensitive to surface conditions and variable from device to device. To achieve optimum device performance it is imperative to decrease the density of these defects, since they are responsible for charge noise (e.g. random telegraph noise) and decreased carrier mobility. Here we report on experimental results from low temperature transport studies of a series of InAs nanowire field effect transistors, each fabricated with a different surface passivation technique. The different surface treatments include combinations of chemical passivation, growth of a thermal oxide, and deposition of a high-k dielectric to determine the optimum process for passivating the surface states. To better quantify the density of surface states, we also study the axial field magnetoconductance of short-channel nanowire transistors, and show how the results can be used to estimate the degree of surface band-bending.

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