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Transport characterization in silicon nanowires[1] DIDIER STIEVENARD, IEMN - Dpt ISEN, FRANCOIS VAURETTE, BRUNO GRANDIDIER, IEMN-Dpt ISEN, DOMINIQUE DERESMES, IEMN-DptISEN, JEAN-PHILIPPE NYS, IEMN-Dpt ISEN — In spite of the great technological interest associated with nanowires, there are only few direct electrical measurements of both the doping level and of the density of surface state. Moreover, the effect of the phonon surface scattering is not well known. We have studied the transport in silicon nanowires, fabricated using e-beam lithography and RIE etching on SOI substrate (thickness of silicon : 20 nm N and P-type intentionally doped at 10^{20}cm^{-3}). The nanowire widths vary from 100 nm down to 10 nm. We can extract the intrinsic resistance of the nanowires, excluding the contacts resistances. We found resistances superior to theoretical resistances. We explain these higher resistances by surface defects on nanowires naturally oxidized and we are able to determine the depletion width due to surface defects, and to deduce the doping level and the density of surface states. We found a reasonable value of 1.10^{13} to 2.10^{13}defects/cm^2, associated with a doping value of 5.10^{19} to 9.10^{19} cm^{-3}. Studies of the transport in the range 80 to 300 K demonstrate that the resistance of the nanowires is mainly bound to phonon scattering localized on the surface (bulk contribution is negligible).

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