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Temperature dependence of electron transport in GaAs nanowires[1] ZHUTING SUN, ANDREI KOGAN, University of Cincinnati, TIM BURGESS, CHENUPATI JAGADISH, Australian National Univerisity — We have measured nonlinear differential conductance through several (n=3) GaAs nanowire samples contacted by lithografically patterned gold-titanium films. The nanowires, 50 nm in diameter, are grown by metalorganic chemical vapour deposition (MOCVD) method in the same growth run and are doped with Silicon during the growth. We compare the measurements to a simple one-dimentional phenomenological model and show that it enables determination of the resistance of the wire and the saturation current and the ideality factor for each contact. Both the saturation current and the ideality factor vary strongly with temperature, as expected. We show that the temperature dependence of the saturation current can be used to determine the doping density and the effective barrier height for each metal-semiconductor contact. We find satisfactory consistency in the doping density obtained in all contacts and discuss variations in the barrier heights determined by this procedure, which we attribute to an inhomogeneous passivation of the surface states of the nanowire at the contact sites. Surprisingly, we find only a weak sensitivity of the nanowire resistance to temperature between 6K and 300 K and discuss a possible effect of the surface states on transport across the wire.

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