Final Year Projects in the Nanoelectronic Materials and Devices (NMD) Group, Tyndall National Institute

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Project 1: Circular TLM assessment

TLM (the transmission line model, and/or the transfer length method) structures are made in a circular design (and/or in a linear design if feasible), using a TMD semiconductor such as MoS_2, WSe_2, etc. on SiO_2/Si substrates. A plan B in the event of processing problems would be to use a III-V semiconductor such as $In_{0.53}Ga_{0.47}As$. The TLM devices will be analysed by IV assessment on our Cascade Probe Station and total resistance versus distance can be plotted. From these plots we can then extract the technologically resistance components for the semiconductor: (1) sheet resistance, (2) contact resistance, (3) specific contact resistivity, and (4) transfer length.

Project 2: Back-Gated Junctionless Transistor assessment

Back-gated junctionless transistor (BG-JLT) structures will be formed using a TMD semiconductor such as MoS_2, WSe_2, etc. on SiO_2/Si substrates. A plan B in the event of processing problems would be to use a III-V semiconductor such as $In_{0.53}Ga_{0.47}As$. The BG-JLT devices will then be analysed by I_{ds}-V_{ds} and I_{ds}-V_{bg} assessment on our Cascade Probe Station to determine field-effect modulation and performance. These output and transfer characteristics can potentially determine field-effect mobility, threshold voltage, subthreshold slope, etc.

Project 3: Van der Pauw 4-Point/Hall-effect analysis

Van der Pauw (VdP) structures will be formed using a TMD semiconductor such as MoS_2, WSe_2, etc. on an insulating substrate. A plan B in the event of processing problems would be to use a III-V semiconductor such as $In_{0.53}Ga_{0.47}As$. The VdP devices will then be analysed by 2-point, 4-point and Hall-effect measurements on our Lakeshore Hall Measurement System (HMS) which has very broad I.R=V capability and an electromagnet powered for a range of ~±1.7 Tesla in DC mode and up to ~+1.24 Tesla RMS in AC mode. We will determine semiconductor resistivity, contact resistance, Hall coefficient, carrier concentration, dominant carrier type and Hall-effect mobility.