Breakage of SET Nanowires and Determination of the Resistivity Constant for Multilayer Graphene

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A Single Electron Transistor (SET) is a device which conducts electrical current through a specified pathway and into a particle in order to study its quantum properties. Initial fabrication yields a SET with two main components: contacts which funnel current and nanowires which hold the particle.The nanowires resemble an hourglass shape, and only after the constricted middle section is broken can a particle be placed in the device. The engineering goals of this project are to (1) successfully break the nanowires in a graphene based SET and (2) experimentally determine the resistivity constant for multilayer graphene. The first is accomplished by wire bonding the sample to a chip carrier, measuring the initial resistance, then running it though a breakage program.The second is determined using the dimensions of the SET nanowires and the measured resistance to plug into the formula R = ?0 (D/A) and determine the presently unknown resistivity constant for multilayer graphene. Fabricating a SET with broken nanowires will study the quantum behavior of particles, which is crucial to the advancement of quantum computing. Presently, there is a cap at which information can be transmitted, as it can only be transcribed through binary code (0’s and 1’s). With quantum computing, bits and bytes of information can be transcribed through states other than zero and one, which translates to theoretically infinite speeds. Characterizing such small particles will reduce the size of processors while exponentially increasing speeds. The SET nanowires were successfully broken and created a 1.7nm gap.The resistivity constant successfully calculated with a 95% confidence interval. This device and its corresponding constant makes crucial movements towards the ideal of quantum computing.

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