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First Principle Simulations of Dual Gate Bilayer Graphene Field Effect Nanotransistors J.E. PADILHA, M.P. LIMA, A.J.R. DA SILVA, A. FAZZIO, University of São Paulo — In this work we present, via first principle calculations, a study of bilayer graphene dual-gate field effect nanotransistor. We show the $I_{ds} \times V_{ds}$ curves as a function of the channel length, back(V_{bg})/$top(V_{tg})$ gate voltages, temperature and charge excess on the system. For this study we use Landauer-Büttiker model with Hamiltonian generated through ab initio Density Functional Theory coupled with non-equilibrium Green's Function formalism. To investigate finite gates we implement a multigrig real space Poisson solver. Our results shows that the current can be tuned varying the strength of the electric field by setting different values of $V_{bg}(V_{tg})$ as well as modifying the channel length. We also show that the current depends on the amount of net charge in the system, controlled by the $V_{bg}(V_{tg})$ values, and the minimum of flowing current occurs when the system is neutral (charge neutrality point) only for gate lengths bigger than $4nm$. In all calculations we find a finite current due to a temperature effect associated with the Fermi-Dirac distribution. Decreasing the temperature from $300K$ to $4.5K$ the current diminishes one order of magnitude. Our study predicts that bilayer graphene dual gate field effect nanotransistors with small channel lengths ($< 5nm$) presents a upper limit for the ON/OFF current ratio of 10 for $300K$ and 100 for $4.5K$. This ratio can be increased using larger channel lengths.

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