Equilibrium charge and potential distribution of a surrounding-gate silicon nanowire in the LDA approximation. BART SOREE, WIM MAGNUS, GEOFFREY POURTOIS, STEVEN COMPERNOLLE, IMEC, Kapeldreef 75, B-3001 Leuven, Belgium, REM TEAM — The equilibrium charge and potential distribution of a silicon nanowire is obtained from a Poisson-Schrödinger solver in the local density approximation (LDA). The cylindrical nanowire consists of heavily doped source and drain regions and the channel region is surrounded by a metallic gate. We have studied different cases where the low dimensionality of the wire has a profound effect on the equilibrium charge and electrostatic potential of the gated wire for different gate voltages. Our calculations show that for short channel lengths the built-in potential is significantly lowered and for small diameters volume inversion occurs. We discuss the possible implications for device performance of these low dimensional effects.

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