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Detection of low energy single ion impacts in silicon transistors[1]

CHRISTOPH WEIS, ARUNABH BATRA, STEFANO CABRINI, LBNL, JEFFREY BOKOR, CHEUK LO, UC Berkeley, THOMAS SCHENKEL, LBNL — We report a technique for single ion doping of field effect transistors through monitoring of changes in the source-drain currents at room temperature [1]. Implant apertures are formed in the interlayer dielectrics and gate electrodes of planar, micro-scale transistors by electron beam assisted etching. Device currents increase due to the generation of positively charged defects in gate oxides when ions (121Sb12+, 14+, Xe6+; 50 to 70 keV) impinge into channel regions. Implant damage is repaired by rapid thermal annealing, enabling iterative cycles of device doping and electrical characterization. We discuss integration of single ion doping for the development of silicon based quantum computer structures with donor electron and nuclear spin qubits. [1] A. Batra, et al., Appl. Phys. Lett. 91, 193502 (2007)

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