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Top-Down Fabricated Silicon Nanochannel Field-Effect Transistors for Biosensing Applications YU CHEN, XIHUA WANG, SHYAMSUNDER ERRAMILI, PRITIRAJ MOHANTY, Physics department of Boston University, NANO LAB OF BU TEAM — Silicon nanochannel field-effect transistors have great promise for biomolecular sensing. The sensitivity is enhanced at the nanoscale due to the large surface-to-volume ratio. Specificity is achieved by functionalizing the devices with selected antibodies or complimentary target molecules. These devices are important as building blocks for high density bionanoelectronics. Top-down fabrication of these devices is compatible with advanced microfabrication processes. We show top-down fabricated silicon nanochannel devices with 3-dimensional relief can serve as a platform for biosensing applications. Three sides of the silicon nanowire are covered with a thin Al₂O₃ layer using Atomic Layer Deposition to form an insulating layer. When the surface is modified for binding to specific biomarkers, the device conductance change can be used to detect binding events through a field effect. Applications include building immunosensors to detect the breast cancer antigen 15-3 and other protein biomarkers, and constructing enzyme-based sensors to detect metabolites like glucose and urea.

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