Label-free sensing with silicon nanowires

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Nanoscale electronic devices have the potential to achieve exquisite sensitivity as sensors for the direct detection of molecular interactions, thereby decreasing diagnostics costs and enabling previously impossible sensing in disparate field environments. Semiconducting nanowire-field effect transistors (NW-FETs) hold particular promise, though contemporary NW approaches are inadequate for realistic applications. We present here [1] a novel approach using complementary metal-oxide-semiconductor (CMOS) technology that has not only achieved unprecedented sensitivity, but simultaneously facilitates system-scale integration of nanosensors for the first time. This approach enables a wide range of label-free biochemical and macromolecule sensing applications, including cell type discrimination through the monitoring of live, stimulus-induced cellular response, and specific protein and complementary DNA recognition assays. An important achievement is the introduction of real-time, unlabeled detection capability, allowing for fundamental studies of cellular activation, and specific macromolecule interactions at sub-femtomolar concentrations. Important aspects of microfluidic integration and Debye screening will be discussed, along with the demonstration of live cell peptide-specific immunoresponse.

QuickTime™ and a
TIFF (LZW) decompressor
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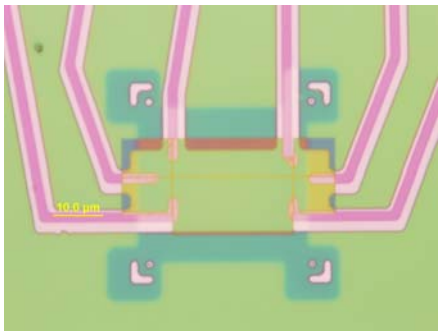

FIG 1. Strepavidin (in PBS) concentration dependence (left) and device micrograph, with ~50 nm Si nanowire active region (right).

1. E. Stern *et al*, *Nature*, **445**, 519 (2007).