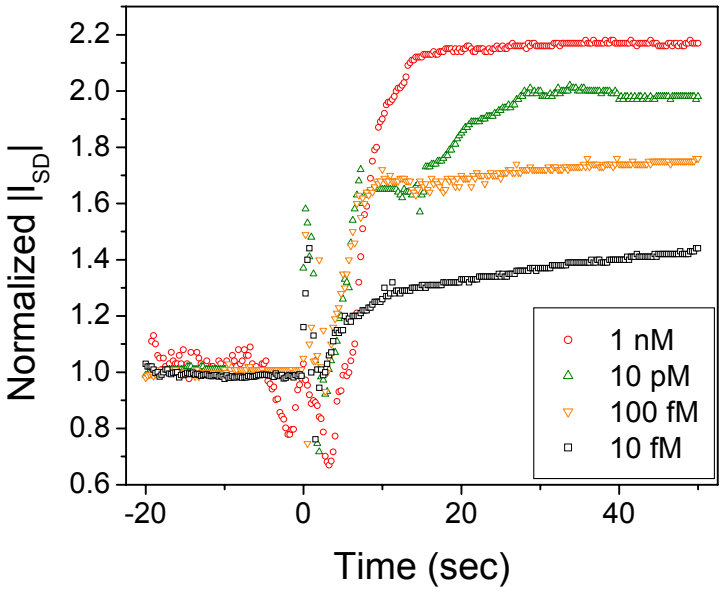
LABEL-FREE SENSING WITH SILICON NANOWIRES

Eric Stern[1], David Routenberg[2], Erin Steenblock[1], Tarek Fahmy[1], & Mark A. Reed[2,3]

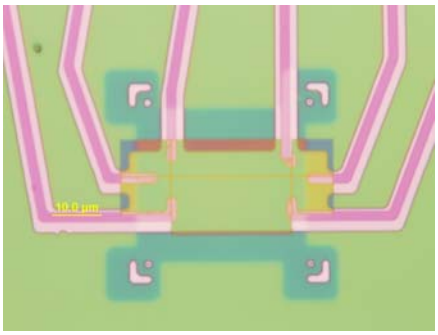
[1]Yale University, Dept. of Biomedical Engineering; PO Box 208284; New Haven, CT 06511
[2]Yale University, Dept. of Electrical Engineering; PO Box 208284; New Haven, CT 06511
[3]Yale University, Dept. of Applied Physics; PO Box 208284; New Haven, CT 06511

ABSTRACT

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 <femtomolar concentrations. Important aspects of microfluidic integration and Debye screening will be discussed, along with the demonstration of live cell peptide-specific immunoresponse [2].



Strepavidin (in PBS) concentration dependence



Device micrograph, with ~50nm Si nanowire active region.

[1] E. Stern et al, *Nature*, **445**, 519 (2007).
[2] E. Stern et al, *Nano Lett.* **8**, 3310 (2008).