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Molecular sensing using point contact conductivity modulation ADAM DICKIE, ROBERT WOLKOW, University of Alberta — The electrical properties of semiconductors are sensitive to external influences, such as the adsorption of gaseous molecules. For single crystal Si surfaces, the change in conductivity induced by molecular adsorption is a very small fraction of the bulk conductivity, precluding their use as efficient sensors. Here we show that point contacts on Si surfaces in UHV environments can overcome this fundamental limitation, through the use of minority-carrier-induced conductivity modulation. Point contacts made to clean, low-doped n-Si(100) produce significant surface inversion layers. The inversion layer minority-carrier population is exponentially dependent upon surface charge. Slight increases in the surface charge density, from gas molecule adsorption, are detected as large increases in sample conductivity, as electrons flow in to balance the positive hole space charge. The sensitivity of this simple device structure is so high that physisorption of inert gas molecules such as He, N<sub>2</sub>, and Ar can be detected as conductivity increases of 2 - 100%; the specific response is proportional to the molecular ionization potential. Decreasing the point contact size, from micro- to nano- to atomic-scale, increases device sensitivity because of increased minority-carrier injection ratios.

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