BILKENT UNIVERSITY

unam - INSTITUTE of MATERIALS SCIENCE & NANOTECHNOLOGY

FACULTY OF SCIENCE

MATERIALS SCIENCE and NANOTECHNOLOGY GRADUATE PROGRAM SEMINAR

"Highly Selective Gas Sensing based on Tunneling Field Ionization on Tailored Semiconductor Nanowires"

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Ionization gas sensors work by fingerprinting the ionization characteristics of distinct gases. Current sensors are limited by their hazardously high-voltage operation, bulky construction and high power consumption. We will present the design, fabrication and successful characterization of gas ionization sensors with very low electrical breakdown of a range of gases and gas mixtures at nanoscale whiskered silicon tips grown by a two-step VLS technique. Branched Si nanotips were formed on Si (111) nanowires by re-flowing SiH_4 into the CVD chamber after an intermediate annealing treatment in HCl ambient. A flat aluminum slab (cathode) was mounted d = 100μm above the nanowires using a patterned polypropylene thin film as a spacer with gas channels. Field-ionization and field-desorption I-V curves of argon, nitrogen and ammonia, were recorded individually within a wide pressure range (10^{-7} to 10 Torr).
Field ionization initiated at sub volt was followed by field desorption at about 7 - 38 V (applied field of ~7×10^2 to ~4×10^3 V/cm). Such voltages are three orders of magnitude smaller than the applied voltages required to generate field ionization on sharp metallic tips having the same tip curvature. The measured I-V curves were pressure dependent. Low voltage filed ionization and desorption phenomena were attributed to the combination effects of geometrical field enhancement on the tip of nanoscale silicon whiskers, the surface states formed by the gold catalyst, and the gold nanoparticles themselves.

Date : June 25, 2010 - Friday
Time : 15:40
Place : Faculty of Science Building, A Block, Seminar Room (SA 240)