NO_2 sensor based on III-V nanowire FET devices

Wei Wang[1, 3], Shirui Guo[2], Miroslav Penchev[3], Mihrimah Ozkan[2,3], Cengiz S. Ozkan[1, 4]
[1] Program of Materials Science and Engineering,
University of California,
900 University Ave., Riverside, CA 92521, USA.
[2] Department of Chemistry,
University of California,
900 University Ave., Riverside, CA 92521, USA
[3] Department of Electrical Engineering,
University of California,
900 University Ave., Riverside, CA 92521, USA
[4] Department of Mechanical Engineering,
University of California,
900 University Ave., Riverside, CA 92521, USA

In this work, we demonstrate the detection of NO_2 using transistors based on single crystalline n-type indium antimonide nanowires devices. Single crystalline (InSb) nanowires are synthesized by ambient pressure chemical vapor deposition (APCVD) technique, using Au particles as catalyst, via a vapor liquid solid mechanism (Figure 1). Structural properties of the as-grown InSb nanowires were investigated by AFM, SEM and TEM analysis. Nanowire Field Effect Transistors (NWFETs) were fabricated in back-gate configuration using SiO_2 as gate insulator (Figure 2). The diameter of InSb nanowires used in the fabricated NWFETs varied from 30-60 nm. The NWFETs show a decrease in conductance upon exposure to NO_2 which is possible due to the charge transfer from the InSb NW surface to the surface absorbed NO_2 molecules. All experimental results suggest InSb NW device as a promising candidate in sensing applications.

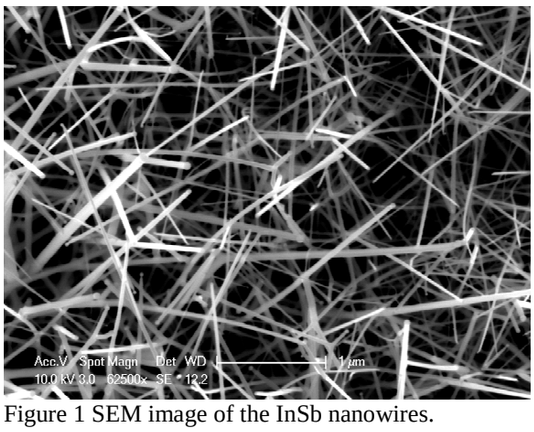

Figure 1 SEM image of the InSb nanowires.

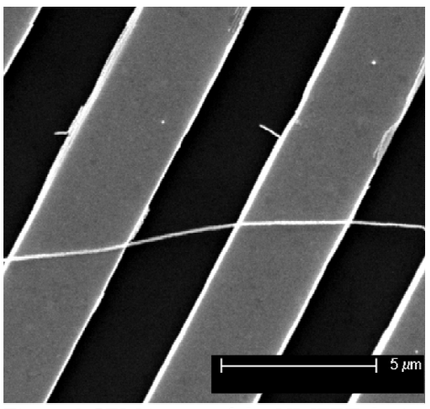

Figure 2 SEM image of the NWFET device.