Thermally oxidized Pd loaded WO_3 nanowires for Hydrogen detection

M.A.H.M.Munasinghe[1,2,*] D. Zappa[2], N.Gunawardhana[2], E. Comini[1]

[1]*SENSOR Laboratory, University of Brescia, Via D. Valotti 9, Brescia, Italy.*
[2]*Centre for Research and International Relations, Sri Lanka Technological Campus, Padukka, Sri Lanka.*

Abstract

Recently, environmental monitoring has become even more pressing need due to the air pollution caused by increasing number of automobiles and industry. In this regard, metal oxide semiconductor-based gas sensors have attracted a great deal of attention due to their high sensitivity, high stability, low cost and easy fabrication. High surface to volume ratio can significantly increase the absorption of the gas molecules and thus growth of 1- D nanostructures is important in enhancing the gas sensing performance. Therefore, WO_3 nanowires were synthesized on alumina substrate (2 mm × 2 mm) by thermal oxidation, which is simple, low cost and catalyst free technique that can be used to grow 1-D nanostructures. RF magnetron sputtering was used to deposit W layers (25 nm), and thermal oxidation was carried out at 600 ºC in an oxygen deficient environment. Further, Pd loading was performed by RF magnetron sputtering at room temperature. XRD revealed that as-prepared WO_3 nanowires were crystalline with a monoclinic phase of WO_3. The structural evaluation showed that oxygen flow plays a crucial role in the growth of WO_3 nanowires. Furthermore, the oxidation temperature and oxidation time have a significant effect on the growth of WO_3. Gas sensing measurements showed that Pd-WO_3 nanowires have the ability to detect H_2 at a low temperature range of 150 -250 ºC. Optimum working temperatures for H_2 and H_2S detection were identified as 250 ºC and 350 ºC, respectively, and a selective detection can be achieved by changing the temperature. These results suggest that Pd-WO_3 sensors are good candidate for detection of H_2 at low temperature range.

Keywords: WO_3 nanowires, Gas sensing, H_2 Sensing, Air pollution, H_2S Sensing.