Design and test of ionization gas sensors based on single metal oxide nanowires

Francisco Hernandez-Ramirez,[1,2] Juan Daniel Prades,[2] Angelika Hackner,[3] Thomas Fischer,[4] Gerhard Mueller,[3] Sanjay Mathur[4] and Joan Ramon Morante [1,2]

1. Catalonia Institute for Energy Research (IREC), Barcelona, Spain
2. Department of Electronics, University of Barcelona, Barcelona, Spain
3. EADS Innovation Works, Munich, Germany
4. Institute of Inorganic Chemistry, University of Cologne, Cologne, Germany

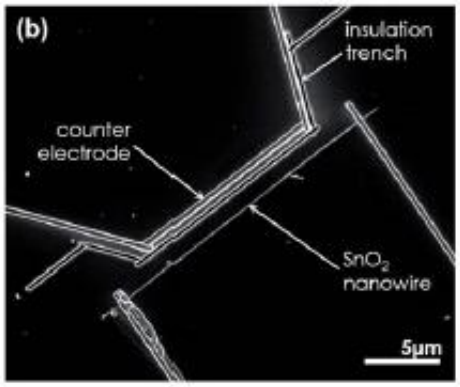
fhernandez@irec.cat, fhernandez@gmail.com

Gas detection experiments were performed with individual tin dioxide (SnO_2) nanowires specifically configured to observe surface ion (SI) emission response towards representative analyte species. These devices were found to work at much lower temperatures (T=280ºC) and bias voltages (V=2V) than their micro-counterparts, thereby demonstrating the inherent potential of individual nanostructures in building functional nanodevices [1]. High selectivity of our miniaturized sensors emerges from the dissimilar sensing mechanisms of those typical of standard resistive-type sensors (RES). Therefore, by employing this detection principle (SI) together with RES measurements, better selectivity than that observed in standard metal oxide sensors could be demonstrated. Simplicity and specificity of the gas detection as well as low-power consumption make these single nanowire devices promising technological alternatives to overcome the major drawbacks of solid-state sensor technologies. In this contribution, the fundamentals of this new line of research and experimental data will be presented and discussed [2].

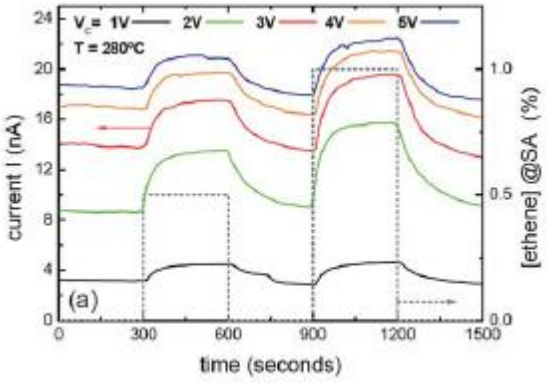
References

[1] A. Hackner, A. Habauzit and G. Müller, Sensors and Actuators B, **146** (2010) 433.
[2] F. Hernandez-Ramirez, J.D. Prades, A. Hackner, T. Fischer, G. Mueller, S. Mathur and J.R.Morante, Nanoscale (2011) DOI: 10.1039/C0NR00528B

Figures



SEM Image of a surface ionization gas sensor based on a single metal oxide nanowire and fabricated with FIB lithography



For the device shown in the previous figure, SI response towards two different concentrations of ethane (0,5% and 1%) diluted in synthetic air at an operation temperature of 280ºC and different working conditions