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Nanosensors based on single and multiple metal oxide nanostructures

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Nanostructured metal oxides are nowadays attracting more and more interest in several fields due to their unique properties. Binary n-type semiconducting oxides (SnO_2 and ZnO principally) are known as excellent gas-sensing materials, whereas p-type oxides (mainly NiO) are only recently being investigated, because they are more difficult to grow in a controlled way. In this presentation, we show both n- and p-type metal oxide nanowires grown by different methods, studying their sensing properties in multi- and single-nanowire devices. Single SnO_2 nanowires are grown by CVD and used to experimentally study the depletion layer modulation model that is at the basis of such sensing devices. The mechanism is confirmed, with a depletion layer experimental value of 14 nm. Furthermore, stable and very fast (few seconds) response and recovery are found, proving that these sensors are good for real-time applications. NiO polycrystalline nanowires grown via a simple hydrothermal method are used as sensors with tunable selectivity in different practical applications related to clean energy: Their response to different gases can be enhanced in order to optimize their use with different steam reforming fuel cells, and demonstrating that post-processing of the nanosensors outputs can be a valuable tool to overcome metal oxide weaknesses. At the end of this contribution, we will show how metal oxide micro- and nanostructures can be functionalized with organic molecules to greatly decrease the working temperature of hybrid sensors close to room temperature. The metal oxide-organics interface seems to be crucial to achieve the best performance.

Biography

Tonezzer Matteo received his PhD degree *cum laude* in Physics at the University of Trento, Italy in 2011. He won the Young Scientist Award from the European Materials Research Society and worked in research centers in France (ESRF), Brazil (UFMG), Vietnam (HUST), Italy (INFM) and USA (GeorgiaTech). He currently works for IMEM in the Italian National Research Council, authored more than 20 papers on international journals, is reviewer for 25 international peer-review journals, Editor of international peer-review journals, and organizer and chairman of international conferences. His main area of interest concerns the sensing properties of nanostructured organic and inorganic materials.

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