EFFECT OF MORPHOLOGY AND DOPING ON THE SENSING PROPERTIES OF SnO_2

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Metal oxide-based gas sensors are widely used due to its high sensitivity to harmful for human health or hazardous gases (such as CO, NO, NO_2, H_2, etc.) in conjunction with easy fabrication methods and low manufacturing costs. SnO_2 is the promising sensor material among a wide set of semiconducting metal oxides due to the number of interesting functional properties such as optical transparency in the visible spectrum, chemical stability at high temperatures, good surface adsorption properties of oxygen and availability of numerous oxygen species and active acid sites on its surface, high specific theoretical capacity, and excellent electrical characteristics.

One of the most important characteristics of semiconducting gas sensors is a sensitivity or sensor signal which is highly dependent on porosity, crystalline size and presence of additives. Considering that the sensing reaction occurring mainly on the surface of sensitive material, one of the first requirements for improving the sensitivity of the sensor is control of particle size of semiconducting materials. Here not only the particles size is important but the morphology of nanostructures as well, because a great impact does the surface-to-volume ratio, increasing of which leads to significant changes in the sensitivity of the sensor. From this point of view, it is very interesting one-dimensional morphology of materials, which provides high values of surface-to-volume ratio while maintaining sufficient chemical and thermal stability with minimum power consumption and low weight. High values of specific surface area show that most atoms (or molecules) are concentrated on the surface. Thus, the reaction between the target gas and chemically active molecules (O^-, O^{2-}, H^+, and OH^-) are possible even at low temperatures. Also, sensor signal as well as the selectivity of gas sensors semiconductor layers can be improved by adding various catalytic additives or modifying sensitive surface layers.