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Metal oxide heterostructures and hybrid nano composite for chemical sensors

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In the field of advanced sensor technology, metal oxide nanostructures are promising materials due to their high charge carrier mobility, easy fabrication and excellent stability. In particular, most of them exhibit a reversible interaction between their surfaces with the surrounding atmosphere. This interaction may lead to a change of some different properties of the material, such as electrical conductance, capacitance, work function or optical characteristics. The Metal-oxide semiconductor gas sensors are viable alternates for highly sensitive and selective detection of different gases and air pollutants, which provide various advantages such as miniaturization, low cost gas detection, and real-time monitoring. Various strategies have been used to increase the gas response and selectivity, including modulating the sensing temperature, [1] morphological control, [2] catalyst doping/loading, [3] and catalytic filtering of interference gases [4].
Another effective strategy to enhance the sensor response and selectivity is to construct the heterojunction between two different oxides that enables the control of conductivity at p-p, p-n, and n-n interfaces, and synergistic catalytic effects between different materials. The framework of the SENSOR laboratory is to studying thoroughly the idea, to bring together the properties of two different nanostructure materials into a single sensing platform by using a common, simple, low cost and high yield growth method. Herein, we report on the novel preparation and characterization of different hetrostructures morphologies such as NiO/ZnO [5] branched 1D-1D nano-heterostructures and NiO/SnO2, CuO/ZnO Core-shell, and SnO2/GO. Several growth techniques has been used for the growth of different heterostructures: vapour phase evaporation and condensation [5], thermal oxidation of a metal film [6], and hydrothermal synthesis and Atomic layer deposition technique. The surface morphology of the nanostructures was investigated by using scanning electron microscopy (SEM) while, for structural characterization GI-XRD, the transmission electron microscopy (TEM), and XPS, Raman spectroscopy, UV-Vis spectroscopy. Figure 1 shows the SEM images of NiO/ZnO, NiO/SnO2, CuO/ZnO, SnO2/GO hetrostructures fabricated on alumina substrate. Finally, heterostructure based conductometric gas sensing devices have been fabricated and tested towards different gases spices such as (NO2, H2, CO, VOC's) and their performance have been compared with the host materials.
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Summary

Topic

1. Physical and Chemical Sensors

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