Metal oxides nanostructures: optimisation of their chemical sensing properties

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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 and 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. Furthermore, one dimensional (1D) semiconductor metal oxides such as nanowires (NWs) have been attracted great deal of attention in the field of chemical sensors due to their unique chemical/physical properties. In chemical sensor, surface of the active materials determines the sensor sensitivity toward specific gas analyte. The enhancement in the sensor response can be achieved by increasing the active surface area of the sensor. Various strategies have been used to increase the gas response and selectivity, including modulating the sensing temperature, morphological control, catalyst doping/loading and catalytic filtering of interference gases, and construing a junction between two materials. Herein, we are presenting on the novel preparation and characterization of different nanostructures and hetrostructures morphologies such as NiO, WO_3, Bi_2O_3 and ZnO NWs, TiO_2 nanotubes and NiO/ZnO, NiO/$NiWO_4$/WO_3 branched heterostructures and NiO/SnO_2, CuO/ZnO Core-shell, SnO_2/Go and WO_3-doped with Nb fabricated using different techniques, their characterization and chemical sensing performance towards different compounds. Further, the sensing properties of ZnO NWs were improved by functionalizing with 3-aminopropyl) trimethoxysilane (APTES). The whole process creates the amino (-NH_2) terminated ZnO surface (SAM) leads to an excellent performance toward acetone.

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