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On the synthesis and characterization of Tungsten Oxide (WO3) doped with Carbon Nanotubes (CNTs) nanostructures for gas sensing applications

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There is a considerable desire to control and monitor gas emissions from industries like in mining and energy industries where fossil fuels are used to generate electric power. Most gases emitted from these industries are not environmental friendly since they result in air pollutions, acid rains and global warming. Gas sensors have been reported as promising devices to resolve these issues. In this study a DC magnetron sputtering is used to synthesis tungsten oxide (WO3) doped with carbon nanotubes (CNTs) nanostructures on silicon substrates for gas sensing applications. CNTs are grown on top of WO3 nanoparticles for improving gas sensing properties of WO3. Crystallinity and porosity of the sensor material is expected to enhance the sensitivity and selectivity of the fabricated gas sensor. The structural, morphological and composition were investigated using XRD, SEM equipped with EDS. SEM results shows small size (in nanoscale) of WO3 particles evenly distributed on silicon substrate with some small spaces in between which is promising for gas adsorption. EDS results confirmed the WO3 composition. Due to the spacings between these nanoparticles of WO3, it is therefore expected that the gas sensing properties of this material will improve. This is due to the fact that gas will be easily be adsorbed between the nanoparticles.

Summary

In this study WO3 nanostructures were successfully deposited on silicon<100>/<111> substrates using DC magnetron sputtering. WO3 films were deposited under various substrate temperatures (450 ºC, 500 ºC, 600 ºC and 700 ºC) for successful crystallization of WO3 films. These films were then characterized by the SEM equipped with EDS and XRD. The balance crystallinity and porosity properties of WO3 nanoparticles were achieved at 500 ºC and due to these properties WO3 is expected to show good gas sensing properties. Gas sensing properties of WO3 will be measured using kinosistec system, and WO3 film is expected to show a good sensitivity and selectivity to NO2 gas. Doping WO3 with CNTs is expected to show good improvement of gas sensing properties of WO3 material.

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Main supervisor (name and email)
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