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Magnetron sputtering of Sn acetylacetonate coatings for sensor applications

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Tin acetylacetonate (SnAcAc) is an organic compound that is widely used as an active medium of chemical gas sensors for the detection of reductive gases like H_2, CO, CH_4. Its functionality is based on changing electrical resistance of the active layer in the presence of adsorbed gas. Thus the adsorption of reducing gas species control the conductivity of layer that strongly depends on surface morphology and structure of SnAcAc. In this work, we focus on the preparation of SnAcAc coatings by magnetron sputtering technology. This solution combines the sputtering target material with subsequent plasma polymerization of the sputtered molecules transported towards the substrate. This polymerization process takes place under suitable conditions of plasmatic discharge and working gas pressure. The SnAcAC coatings were prepared by means of RF magnetron sputtering from SnAcAc target in Ar gas. The sensitivity of the active medium can be enhanced by uniformly embedded SnO_2 nanoparticles in the SnAcAc matrix. Therefore, we prepared the target by mixing the SnAcAc with SnO_2 powder at different proportions, followed by a pressing and sintering process. The gas pressure was chosen between 2 and 10 Pa to tune the polymerization process. We prepared a number of samples of SnAcAc coatings on Si and fused silica substrates. The surface morphology of the prepared coatings was studied by means of scanning electron microscopy (SEM) and atomic force microscopy (AFM). The chemical bonding was studied using infrared and Raman spectroscopies. The electron-transport properties were evaluated by Van der Pauw method and Hall effect measurement. These layers were also deposited on special sensor substrates with interdigital Pt electrodes to test their sensitivity to the selected gases.

Keywords
Magnetron sputtering, acetylacetonate, gas sensors