Abstract

In the first part of this work, thin films of ZnO–SnO_2composites have been deposited on Si(100) and glass substrates at 500 °C bypulsed laser ablation using different composite targets with ZnO amount varying between 1 and 50 wt%and subsequently annealedat 600 °Cfor 1 h in oxygen atmosphere.In case of as deposited ZnO–SnO_2composite films, the best combined property, as indicated by the figure ofmerit, is obtained for the film with 1 wt% ZnO content. The band gap of the post-annealed ZnO–SnO_2composite filmsdecreases from 3.8 eV − 3.46 eV.In addition, p-typeAl-doped SnO_2 thin films (containing 1, 3 and 5 wt% Al) were deposited under similar experimental conditions to study the effect of aluminium concentration and post deposition annealing on structural, optical and low temperature resistivity properties. GIXRD and FESEM results indicate that an increase in dopant concentration (Al^{3+}) promotes amorphous instead of crystalline state and deteriorates optical transparency and electrical conductivity. The combined TCO property (expressed as figure of merit), shows that the opto-electronic property of the films can be improved by annealing compared to that in as-deposited condition and the highest Φ_{TC} has been achieved in the film with 3 wt% Al in annealed condition.In the second part of this thesis, synthesis of well aligned $SnO_2$and ZnObased 1-D nanostructures by means of a simple evaporation and condensation process has been successfully done and the growth mechanism of these novel nanostructures has beendescribed. Thegrowth and resultant morphology of these nanostructures is controlled by acatalyst free vapour-solid (VS) mechanism. We further demonstrated that the morphology of pure and hybrid/doped $SnO_2$and ZnObased nanostructurescan be controlled by varying the parameters viz., growth duration, soaking temperature, gas (Ar/O_2) flow rate and initial composition.The gas sensing characteristics (response %, response/recovery time) of the as-deposited pure and hybrid oxides were evaluated in a lab-scale fabricated automated gas measurement set up.It is found that the $SnO_2$and ZnObased pure and hybrid nanostructures with novel morphology and prepared by thermal evaporation method, exhibits promising gas sensing performance and is at par with the existing materials.

Keywords: thin films, resistivity, nanostructures, opto-electronic, gas sensing