World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:17, No:08, 2023

Effect of Intrinsic Point Defects on the Structural and Optical Properties of SnO_2 Thin Films Grown by Ultrasonic Spray Pyrolysis Method

Authors : Fatiha Besahraoui, M'hamed Guezzoul, Kheira Chebbah, M'hamed Bouslama

Abstract : SnO_2 thin film is characterized by Atomic Force Microscopy (AFM) and Photoluminescence Spectroscopies. AFM images show a dense surface of columnar grains with a roughness of 78.69 nm. The PL measurements at 7 K reveal the presence of PL peaks centered in IR and visible regions. They are attributed to radiative transitions via oxygen vacancies, Sn interstitials, and dangling bonds. A bands diagram model is presented with the approximate positions of intrinsic point defect levels in SnO_2 thin films. The integrated PL measurements demonstrate the good thermal stability of our sample, which makes it very useful in optoelectronic devices functioning at room temperature. The unusual behavior of the evolution of PL peaks and their full width at half maximum as a function of temperature indicates the thermal sensitivity of the point defects present in the band gap. The shallower energy levels due to dangling bonds and/or oxygen vacancies are more sensitive to the temperature. However, volume defects like Sn interstitials are thermally stable and constitute deep and stable energy levels for excited electrons. Small redshifting of PL peaks is observed with increasing temperature. This behavior is attributed to the reduction of oxygen vacancies.

Keywords : transparent conducting oxide, photoluminescence, intrinsic point defects, semiconductors, oxygen vacancies
Conference Title : ICPSDSA 2023 : International Conference on Power Semiconductor Devices, Systems and Applications
Conference Location : Istanbul, Türkiye
Conference Dates : August 17-18, 2023