Sensors and Actuators B: Chemical
Volume 177, February 2013, Pages 1128-1133

Effect of annealing and temperature on the NO_2 sensing properties of tellurium based films

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https://doi.org/10.1016/j.snb.2004.02.005

Abstract

Influences of temperature and annealing on the electrical and sensing properties toward NO2 of tellurium based films were investigated. The annealing at temperatures more than 100°C causes a sharp decrease both of electrical resistance and sensitivity of the films. SEM analyzes indicated that annealing induced structural evolution of the films, including growth of large crystals in the matrix. Temperature-dependent electrical conductivity is strongly affected by presence of an NO2 environment. The sensitivity toward NO2, being controlled by gas concentration, decreases with operating temperature increase. On the other hand, the increase of operating temperature leads to a reduction of response–recovery times. The results are discussed taking into consideration the contributions of grain boundary as well as grain bulk and surface resistance to the total conductivity. It is assumed the surface, including grain boundary, hole-enriched region is formed as a result of dangling bond chalcogen's lone-pair electron interaction. Chemisorption of NO2 molecules is accompanied by hole enrichment of the surface and grain boundary region, due to interaction of these molecules with lone-pair electrons.