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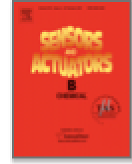

Investigation of the oxygen, nitrogen and water vapour cross-sensitivity to NO_2 of tellurium-based thin films

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Abstract

Effect of O_2, N_2 and H_2O to electrical behavior of tellurium-based films as well as cross-sensitivity to NO_2 gas has been studied at temperatures between 20 and 70°C. The increase of oxygen partial pressure in N_2+o2 carrier gas results in a nearly linear decreasing of the film resistance. The complete impulsive substitution of nitrogen by oxygen decreases the resistance of the film with ~6% in 1.5h, which is far below the much faster response of 50% with 1.5ppm NO2. The effect of humidity is more perceptible. At room temperature the resistance of the films increases with 15% at 58% RH, but humidity has negligible effect at temperatures higher than 50°C. At an appropriate temperature, humidity does not interfere with NO_2. Our results suggest that effect of water vapour is due to simple physical adsorption, whereas effect of oxygen and nitrogen is the consequence of “week” chemisorption of these molecules on the film surface. The NO_2 sensing mechanism involves “strong” chemisorption due to interaction between odd electrons of nitrogen dioxide molecules and lone-pair electrons of tellurium-based chalcogenides.