Nanocomposites and nanomaterials

Semiconductor gas sensors based on Pd/SnO_2 nanomaterials for methane detection in air

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Adsorption semiconductor sensors can be used for detection of explosive gas leakages because of their low cost, simple construction, low power consumption and high sensitivity. Sensing mechanism of the sensors can be explained by running catalytic process of oxidation of an analyzed gas on the sensor surface. Chemisorbed oxygen can oxidize the detected gas, which causes a change of electrical resistance of the sensor. A ratio between the electrical resistances in air (R_0) and in the presence of the gas (R_g) was chosen as a measure of the sensitivity of the sensors.

In this work the sensitivity to methane of the sensors based on Pd/SnO_2 nanomaterials was studied. Tin dioxide is widely used material for a gas sensitive layer because of it chemical stability. Palladium is known to be one of the most active catalysts for the full oxidation of CH_4. It is shown that addition of palladium to the gas sensitive layer of the sensors based on the nanosized SnO_2 by wet impregnation technique, using $PdCl_2$ solutions (0.21×10^{-2} - 35×10^{-2} M), leads to significant increasing of the sensitivity to methane (Fig. 1), which can be explained by increasing the methane oxidation rate.

Fig.1. Dependences of the sensor response to 937 ppm CH_4 on temperature for the sensors based on nanosized Pd/SnO_2 materials with different Pd loading.