Nanocomposites and nanomaterials

Influence of particle size of Pd/SnO_2 nanomaterials on their sensor properties

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Hydrogen is widely used for chemical synthesis in industry and as an environmentally friendly energy source. Hydrogen is an explosive gas and that's why control of H_2 concentration in air is a very important problem. Sensitivity of the sensor is determined by properties of its gas-sensitive layer material. In the same time the properties of the sensor material depends on its composition, method of its preparation, conditions of its formation that influence on the size of its particles. The aim of this work is to study the influence of the particle size of Pd/ SnO_2 nanomaterials on the sensitivity of the semiconductor sensors to H_2.

In this work Pd/SnO_2 nanomaterials for the gas sensitive layer with the average particle size of 14 and 10 nm were obtained (Fig.1). To increase the sensitivity of the sensors the materials were doped by different palladium quantities.

Fig.1. Dependence of the sensor response to 40 ppm H_2 on the Pd content (wt%) at different temperatures of the sensors based on Pd/SnO_2 materials with average particle size: a –10 nm; b – 14 nm.

The observed curves have similar extermal character for both materials (Fig.1, a,b). The sensor that contain 0,090 wt.% Pd with the smaller average particle size (10 nm) have the higher sensitivity to 40 ppm H_2 than the sensor with 0,016 wt.% Pd. Shift of the maximum sensitivity to higher concentrations of palladium for the sensors with the smaller particle size compared to the sensors with the larger particle size can be explained by increasing a length of common borders between grains of Pd and SnO_2 when Pd presents in the nonaggregated state.