Nanocomposites and nanomaterials

Gas sensitive materials based on nanosized tin dioxide doped by palladium for adsorption semiconductors sensors to methane

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In spite of alternative energy development fossil fuels are still extremely important energy carriers. Among them natural gas is one of the most commonly used and environmentally friendly. However, the use of natural gas assumes to control its leaks, because methane, the main component of natural gas, can combine explosively with air. That's why control of the methane presence in the air is required. Various types of detectors can be used for this purpose. Among them the adsorption-semiconductor sensors are quite promising due to high sensitivity, low power consumption and small sizes. The main component of the sensors is a semiconductor gas sensitive layer (usually based on SnO_2). On its surface catalytic oxidation of methane molecules by chemisorbed oxygen occurs, that causes changes in the electrical resistance of the sensor. Since methane is quite chemically inert, the addition to the gas sensitive layer of such active CH_4 oxidation catalyst as Pd should increase the response of sensors.

Investigation of the nanoscale gas sensitive materials has shown influence of Pd on average tin dioxide nanoparticles size. Introduction of palladium causes a decrease in the SnO_2 particle size from approximate 14 nm (pure SnO_2) to around 8 nm (2.45% Pd). The study of sensors based on nanosized Pd/SnO_2 doped with palladium showed their high sensitivity to 930 ppm CH_4 (Fig.1), that is 8-9 times higher in comparison with the non-modified sensors. It can be explained not only by the influence of palladium catalytic activity in the methane oxidation reaction, but by the decrease in the particles size of the tin dioxide also.

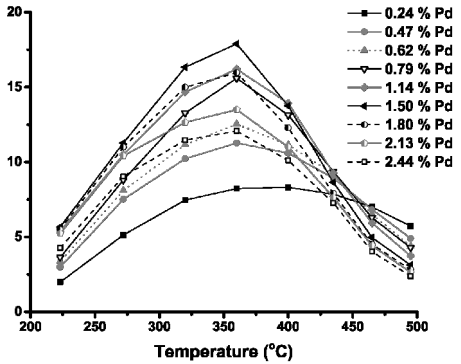

Fig.1. Temperature dependences of the sensor response to 930 ppm CH_4 for the sensors based on nanosized Pd/SnO_2.