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The Influence of the Electrode Material on the Sensor Characteristics of SnO_2 Thick Film Gas Sensors

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A chemoresistive SnO_2 based gas sensor allows for measuring the resistance of the sensing layer between two electrodes in order to provide information about the chemical composition of the ambient atmosphere.

It is well documented that besides making possible the resistance measurement, the noble metal electrodes have an impact on the sensing performance because of various reasons. Some of them are purely electric in nature - the electrode gap determines the number of grain-grain boundaries - but there is also an important chemical influence due to the catalytic processes taking place at the three phase boundary: electrode/metal oxide/ambient atmosphere. By only measuring the sensor resistance one experiences all those influences but one also lacks the needed information to be able to understand their causes and the way in which it would be possible to use them.

In this work we report on operando measurements performed on screen printed thick-film SnO_2 sensors on Al_2O_3 substrates and on the corresponding model systems for the electrode-metal oxide interface: mixtures between SnO_2 powders and micrometric Au and Pt powders. The measurements were performed in dry and humid air backgrounds in the presence of various CO, H_2 and oxygen concentrations. The experimental methods are DC electrical measurements, catalytic conversion experiments and DRIFTS measurements.

Thus it could be shown, that for sensors with gold electrodes at lower working temperatures, the activation of the oxygen adsorption and the resulting increase of ionosorbed oxygen, makes the sensor more capable for reaction with gases like CO and H_2. Sensors with platinum electrodes, on the other hand, show decreased signals at selected temperatures because of the direct conversion at the noble metal electrodes.