

Electrical properties of metal oxide nanoparticles: application to gas detection

Most of metal oxides studied in our group (SnO_2 , ZnO , In_2O_3) are wide gap semiconductors for which conductivity may vary when exposed to oxidizing or reducing gases. This property is controlled by adsorption/desorption phenomena at their surface. These phenomena are generally accompanied by electronic transfers between the chemisorbed molecules and the semiconducting material which are at the origin of the conductivity variations. The presence of a reducing gas (CO , hydrocarbons, H_2 , alcohol vapours...) gives rise to an increase in conductivity whereas the presence of an oxidizing gas (NO_2 , O_3) gives rise to the opposite behaviour. These processes are generally reversible and can be exploited for gas detection. The detection threshold together with the response time and the reproducibility are closely related to the composition, the morphology – which has to be controlled at a nanometric scale – and the surface state of the semiconducting material.

The following figures illustrate the influence of *i*) Pd and Pt doping of tin dioxide^[1] (figure 1) and *ii*) the nature of the metal oxide (figure 2) on the detection of various gases.^[2]

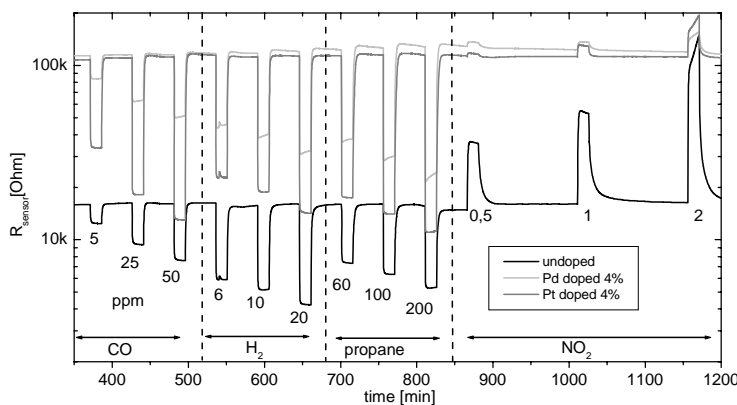


Figure 1
Effect of Pd and Pt doping on the detection of CO , C_3H_8 , H_2 and NO_2 by SnO_2 -based sensitive layers

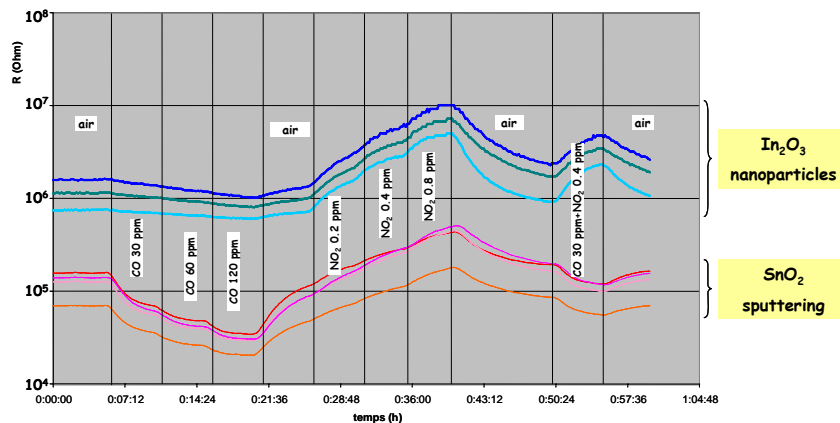


Figure 2
Influence of the nature of the metal oxide on the detection of CO and NO_2

^[1] P. Menini, F. Parret, M. Guerrero, A. Martinez, K. Soulantica, L. Erades, A. Maisonnat, B. Chaudret, *Sens. Actuators B*, **2004**, *103*, 111

^[2] K. Soulantica, L. Erades, M. Sauvan, François Senocq, A. Maisonnat, B. Chaudret, *Adv. Funct. Mater.*, **2003**, *13*(7), 553