

## ***Sol-Gel Films containing Metal and Semiconductor Nanoparticles For Gas Sensing***

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Functional nanocomposite films have been obtained by doping sol-gel films with metal and semiconductor nanoparticles for gas sensor application.

Three synthetic approaches were adopted, each of them characterized by a systematic increase of the final materials morphology, structure and micro-structure control. The synthesized layers comprised of an inorganic porous matrix ( $\text{SiO}_2$ ,  $\text{TiO}_2$  and  $\text{NiO}$ ) containing nanosized metal (Au, Pt) or semiconductor crystals ( $\text{NiO}$ ), and were shown to be active materials for chemical recognition of  $\text{H}_2$  and CO. The films were deposited onto different sensing supports, leading to successful gas detection via optical, conductometric and surface acoustic wave interfaces.

$\text{SiO}_2$ - $\text{NiO}$ -Au systems are capable to selectively detect  $\text{H}_2$  using an optical interface thanks to a marked wavelength dependence of its sensitivity toward this specie. However, if a peculiar  $\text{NiO}$ -Au morphology is obtained inside the  $\text{SiO}_2$  support CO is more likely to be detected.

$\text{TiO}_2$ -Au thin films have shown to be excellent conductometric sensors for  $\text{H}_2$  detection, and ideal gas-sensing dynamics have been observed in this case. This class of layers demonstrated to be effective also for  $\text{H}_2$  detection through a Surface Acoustic Wave (SAW) interface.

Monolayers of Au nanoparticles covered by a thin  $\text{NiO}$  layer showed promising sensing dynamics in the optical recognition of  $\text{H}_2$ . In this case the material synthesis allows for a detailed control of the single nanocomposite constituents, thus opening the possibility for a finer tuning of the sensor sensitivity.