



# The effect of Au nanoclusters in tin oxide film gas sensors

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The effect of Au nanoparticles in SnO<sub>2</sub> was investigated for gas sensor applications. The films were prepared by the sol-gel method. HAuCl<sub>4</sub> in different concentrations was added to a tin alkoxide solution, the mixture was hydrolyzed and spin coated on borosilicate glass substrate. The samples were thermally treated to remove the organics. The change of the electrical conductivity was used to detect H<sub>2</sub>. The response of SnO<sub>2</sub> and SnO<sub>2</sub> - Au to H<sub>2</sub> was investigated at different temperatures and concentrations.

## In situ preparation of Au nanoparticles in SnO<sub>2</sub> matrix

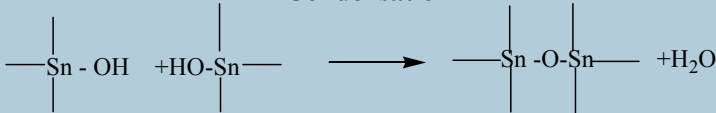
### Synthesis of Tin Alcooxide



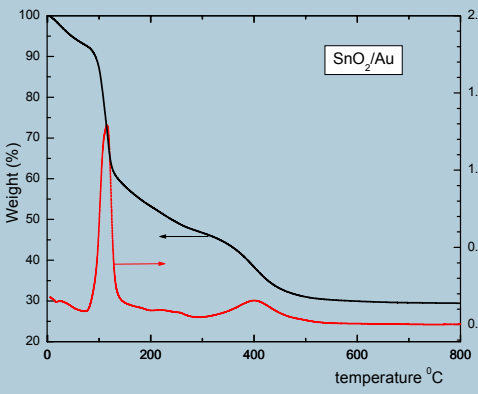
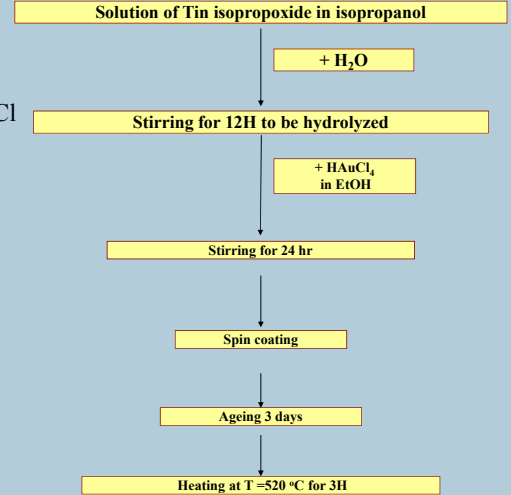
### Hydrolysis of Tin Alcooxide



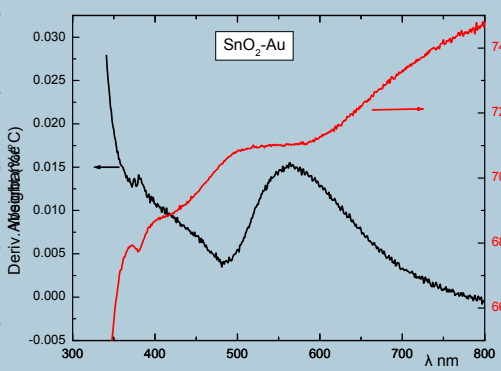
### Condensation



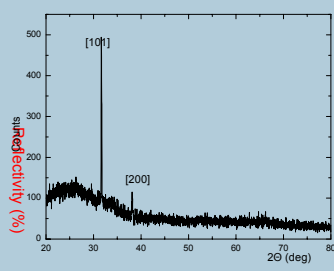
## Preparation of SnO<sub>2</sub> films doped with Au nanoparticles



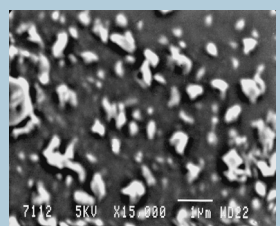
TGA of the SnO<sub>2</sub> film. The isopropanol and the water evaporate at 118°C and the remaining organics are burned up to 400°C. At 400°C the HAuCl<sub>4</sub> is reduced to metallic Au. After 500°C there is no loss of mass.



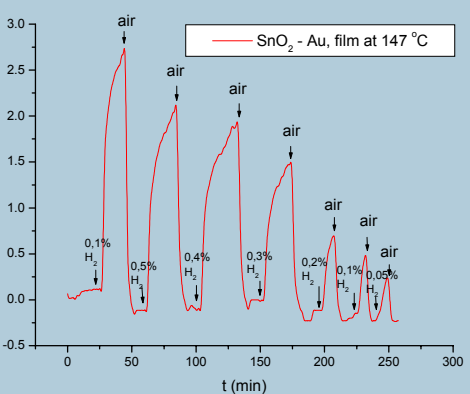
UV-vis absorption (Black) and Reflection (Red) spectrum: The peak at 560nm is due to Au surface plasmon (SPR). Size of Au nanoparticles according to FWHM: 3.5nm



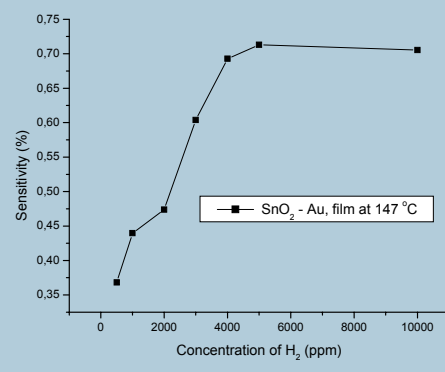
XRD Spectra: A clear tendency of texturing on [101] crystalline direction of tetragonal rutile structure can be seen.



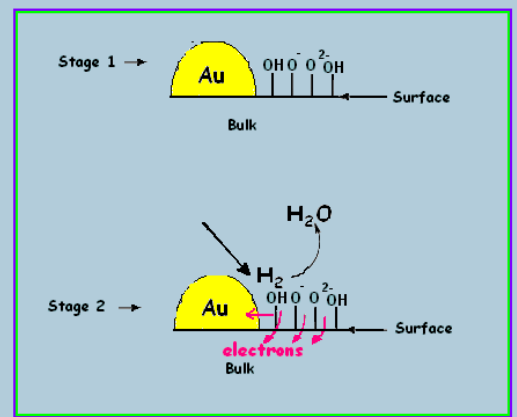
SEM image: homogeneous dispersion of Au nanoparticles irregular shaped with dimensions of few hundreds nanometers



Response of the current through a Au-doped SnO<sub>2</sub> film against different concentrations of H<sub>2</sub> at 147°C (applied constant voltage 1 V)



Sensitivity of Au-doped SnO<sub>2</sub> versus various concentrations of H<sub>2</sub> at working temperature 147°C.



Proposed sensing mechanism for H<sub>2</sub> sensing