



The effect of Au nanoclusters in tin oxide film gas sensors

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The effect of Au nanoparticles in SnO₂ was investigated for gas sensor applications. The films were prepared by the sol-gel method. HAuCl₄ 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 H₂. The response of SnO₂ and SnO₂ - Au to H₂ was investigated at different temperatures and concentrations.

In situ preparation of Au nanoparticles in SnO₂ matrix

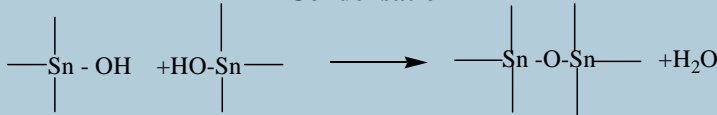
Synthesis of Tin Alcoxide



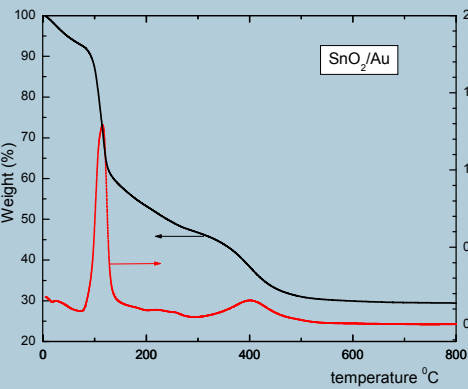
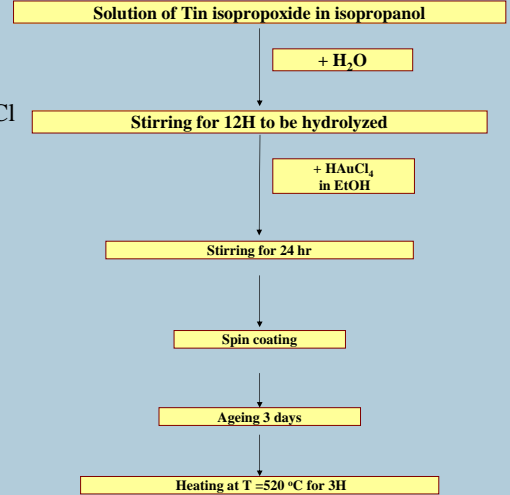
Hydrolysis of Tin Alcoxide



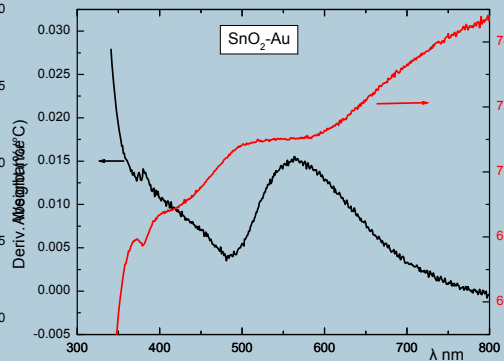
Condensation



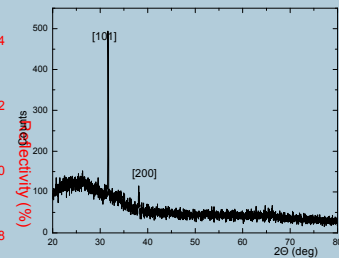
Preparation of SnO₂ films doped with Au nanoparticles



TGA of the SnO₂ film. At 118°C the isopropanol and the water evaporate the remaining organics are burned up to 400°C. At 400°C the HAuCl₄ is reduced to metallic Au. After 500°C there is no loss of mass.

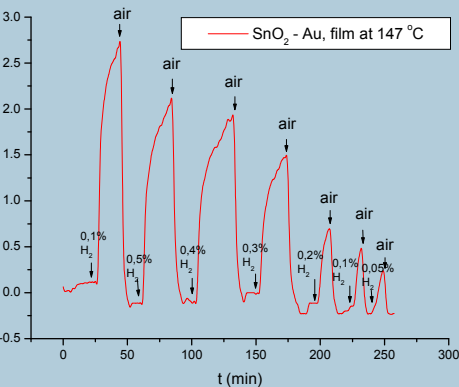
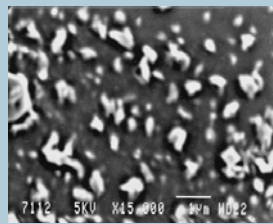


UV-vis absorption (Black) and Reflection (Red) spectrum: The peak at 560nm is due to Au plasmon
Size of Au nanoparticles according to FWHM: 3.5nm

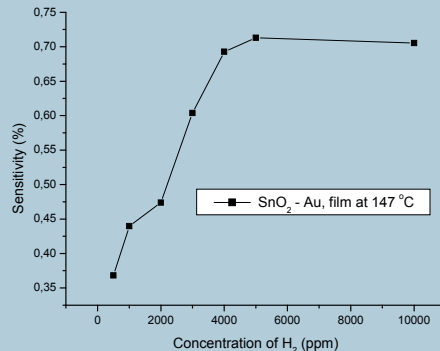


XRD Spectra: it can be seen a clear tendency of texturing on [101] crystalline direction of tetragonal rutile structure

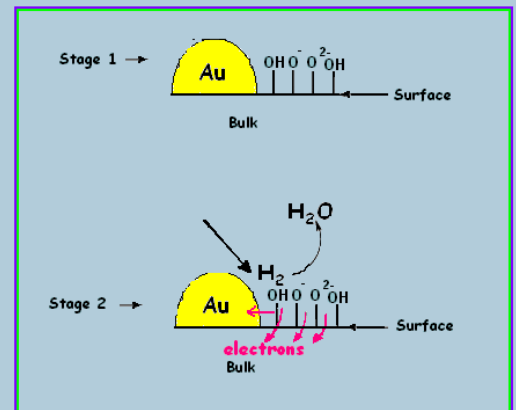
SEM image: homogeneous dispersion of Au nanoparticles irregular shaped with dimensions of few hundreds nanometers



Response of Au-doped SnO₂ against different concentrations of H₂ at 147°C (applied constant voltage 1 V)



Sensitivity of Au-doped SnO₂ versus various concentrations of H₂ at working temperature 147°C.



Proposed sensing mechanism for H₂ sensing