213. Ultraviolet Excitation of Photoconductivity in Thin Films of Sol -Gel SnO_2

L. V. A. Scalvi [*1], *V. Geraldo* [2], *E. A. Morais* [1], *C V Santilli* [3], *P. B Miranda*[2], *T J Pereira*[1]

1 Dep. Física – Faculdade de Ciências, UNESP Bauru, Brazil
2 Instituto de Física de São Carlos – USP, Brazil
3 Instituto de Química - Araraquara, UNESP, Brazil
* - corresponding author – address: Dept. Física – UNESP, C. Postal 473, 17033-360 Bauru SP, e-mail: scalvi@fc.unesp.br

Transparent tin dioxide films have widespread application as gas sensors, solar collectors and optoelectronic devices. Although technological interest has grown, the nanoscopic feature of sol-gel films leads to amazing unknown transport properties. A complete understanding of electrical transport in SnO_2 has not been reached yet. In this communication we report some results concerning photoinduced electrical transport in SnO_2 obtained by sol-gel, either by dip-coating technique as well as spin-coating. Grain size evaluated from X-ray diffraction results yields nanocrystallites in the range 3-15nm. Photoconductivity of undoped SnO_2 film is excited at low temperature, by using the fourth harmonic of a Nd:YAG laser (266nm). Best results are in the range 70-200K. The conductivity increases drastically under laser irradiation until practically saturates. The lower the temperature the higher the reached conductivity, in agreement with a dominant grain boundary scattering dominant model, since in such a low grain size, bulk scattering phenomena become practically irrelevant. After removing the illumination, the conductivity remains unchanged as long as the temperature is kept constant. Film conductivity changes when the temperature is increased, however it only returns to original resistance value after a few hours. This return to original values discharge possibilities of local structural effects such as laser induced burns. The photocurrent spectra in the range 200-400nm, is obtained by using a deuterium source. These spectra are measured for the first time as function of temperature. Normalization by the photon flux reaching the sample, leads to increasing photocurrent for illumination with monochromatic light of increasing energy. The photocurrent quantum yield has an onset at the absorption edge (about 300nm) and continues to increase even for photon energies much higher than the bandgap transition. The explanation for these results is related to recombination of photogenerated electron-hole pairs with grain boundary adsorbed oxygen.