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# Desertion Influence of Water on Structural, Electrical Properties and Molecular Order of $V_2O_5.nH_2O$ films

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**Abstract.** $V_2O_5.nH_2O$ films were grown by the sol-gel method on glass substrates pre-treated, gelation time was 14 days. The crystallinity of the films was checked with X-ray diffraction (XRD) identifying the parameter of lattice $a$=12.572± 0.004Å. The electrical resistance presents an Arrhenius behavior type, thermally activated and irreversible. The energies of activation for three consecutive heating cycles were: 0.247, 0.257 and 0.262eV, respectively. Micro-Raman spectroscopy showed the influence of temperature the $V_2O_5.nH_2O$ films, presenting a transition from crystalline-amorphous phase for temperatures above 272°C, inferring, that the water presents in the sample is responsible for the crystallinity of the material.

In this work, $V_2O_5.nH_2O$ films were prepared by the method of sol-gel, using the peroxovanadic acid solutions route, at deposition of room conditions. The solution was left standing for 14 days. The films growth were performed by slow immersion of glass substrates previously treated, then dried in ambient conditions for 24 hours. The crystallinity of the films was checked through X-ray diffraction at room temperature, confirming the preferential growth direction [h00] with the lattice parameter $a$=12.572± 0.004Å. which is bigger than the reported in [1], we believe that the difference is mainly due to the "free" bond between molecules in the polymerization process generating structures more stable and farther away, predominating this effect on the solvent evaporation during the gelation process. The electrical resistance showed a behavior thermally activated Arrhenius type. Where, the temperature activates the release of constituent water in an irreversible process. This activity is accompanied by an increase in the number of vacancies and imperfections on the crystal network, decreasing the electrical conductivity. The activation energies for three consecutive heating cycles were: 0.247, 0.257, 0.262 (±0.001) eV respectively.

µ-Raman spectroscopy as a function of temperature at atmospheric pressure, showed the presence of modes associated with the relative movements of structural units (low frequency) and internal modes (high frequency). Raman bands in the region from 170 to 1200 cm$^{-1}$ also showed that the position is invariant to the increase of temperature, while around 272ºC showed the presence of two new bands located at 938 and 1018 cm-1 respectively, which is in good agreement with those reported in [2]. The appearance of a new width band is evidence of one amorphous phase that is present in the films.

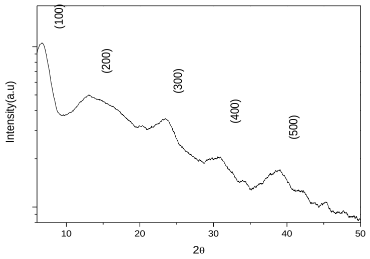

**Figure 1:** X-ray diffraction of $V_2O_5.nH_2O$ *films* at room temperature.

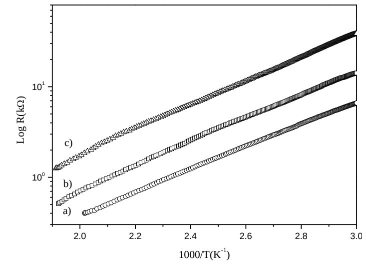

**Figure 2:** Temperature dependence of the electrical resistance for three heating cycles: a) first, b) second and c) third

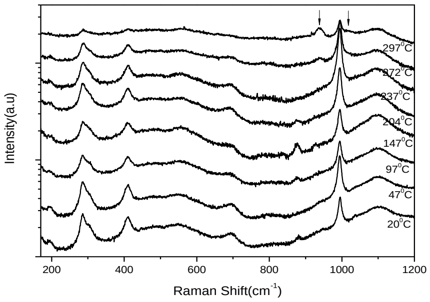

**Figure 3:** Temperature dependence of the µ-Raman spectrum of $V_2O_5.nH_2O$ films.

## References

[1] Bruno Alonso and Jacques Livage, J. Solid State Chemistry, 148 (1999)16
[2] Se-Hee Lee, Hyeonsik M. Cheong, Maeng Je Seong, Ping Liu, C. Edwin Tracy, Angelo Mascarenhas, J. Roland Pitts, Satyen K. Deb, Solid State Ionics 165 (2003)111