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Lisbon, 10<sup>th</sup> September 2009

REFERENCE: Short Term Scientific Mission, COST CM0601  
Beneficiary: Susana Sérgio Venceslau, New University of Lisbon (PT)  
Host: Soren Vronning Hoffmann, Institute for Storage Ring Facilities (ISA), University of Aarhus, Denmark.  
Period: from 23/08/2009 to 30/08/2009 Place: Aarhus (Denmark)  
Reference code: COST-STSM-CM0601-04975

## SCIENTIFIC REPORT

### ***PURPOSE OF VISIT***

The scientific mission to the Institute for Storage Ring Facilities (ISA), University of Aarhus, Denmark, was devoted to the VUV photoabsorption experiments of oxide thin films ( $\text{TiO}_2$  and  $\text{TiO}_x\text{N}_y$ ) for environmental decontamination purposes in order to characterize the electronic state spectroscopy of such films and therefore extend the full characterization into lower wavelengths. This seems to be particularly important to understand structural and chemical modification of such materials.

### ***DESCRIPTION OF THE WORK CARRIED OUT DURING THE VISIT***

During this STSM, it was possible to take several high resolution VUV photoabsorption spectra of  $\text{TiO}_2$  and  $\text{TiO}_x\text{N}_y$  thin films.

These films were produced in the Lisbon Laboratory by magnetron reactive sputtering and by sol-gel spin coating methods, with thickness up to 20 nm. For the former, the Lisbon group is capable of producing these films in a custom made dual-magnetron codeposition apparatus. In both cases the thin films were deposited into  $\text{CaF}_2$  substrates.

### ***DESCRIPTION OF THE MAIN RESULTS OBTAINED***

During this scientific mission was possible to obtain high resolution VUV photoabsorption spectra of  $\text{TiO}_2$  and  $\text{TiO}_x\text{N}_y$  thin films prepared by:

1. magnetron reactive sputtering (two set of samples for each system,  $\text{TiO}_2$  and  $\text{TiO}_x\text{N}_y$ , were measured: as-sputtered and after annealing at  $400^\circ\text{C}$  in a tubular furnace)
2. sol-gel spin coating (two, set of samples were measured, one with less N content and another with higher N content).
3. Due to the on-going activities of the Lisbon group, especially with gas phase experiments on aeronomic and biological relevant molecules, it was also possible to the applicant to get

involved and taking part in the experiments on isobutylacetat.

A preliminary analysis and comparison of the VUV photoabsorption spectra of the films obtained by magnetron reactive sputtering and by sol-gel spin coating methods reveals some differences, which probably may be attributed to the distinct preparation conditions (please see Fig 1 and 2 in the appendix). Shortly the obtained data on  $\text{TiO}_2$  and  $\text{TiO}_x\text{N}_y$  will be carefully analyse to be submitted to a international journal.

### ***FUTURE COLLABORATION WITH HOST INSTITUTION***

This research joint programme will continue. Research will be devoted to the electronic state spectroscopy of other oxide thin films important for environmental applications, especially those with other morphological properties such as  $\text{ZnO}$ ,  $\text{MoO}_2$  and  $\text{WO}_3$ .

### ***PROJECTED PUBLICATIONS/ARTICLES RESULTING OR TO RESULT FROM THE GRANT***

Publications will emerge during the next months as soon as we compile and analyse the relevant data recorded for  $\text{TiO}_2$  and  $\text{TiO}_x\text{N}_y$  thin films.



Susana Sérgio Venceslau

## APPENDIX I - Recent results from the STSM to Aarhus.

Figure 1 – High resolution VUV photoabsorption spectrum of  $\text{TiO}_x\text{N}_y$  thin film obtained by DC-magnetron sputtering.

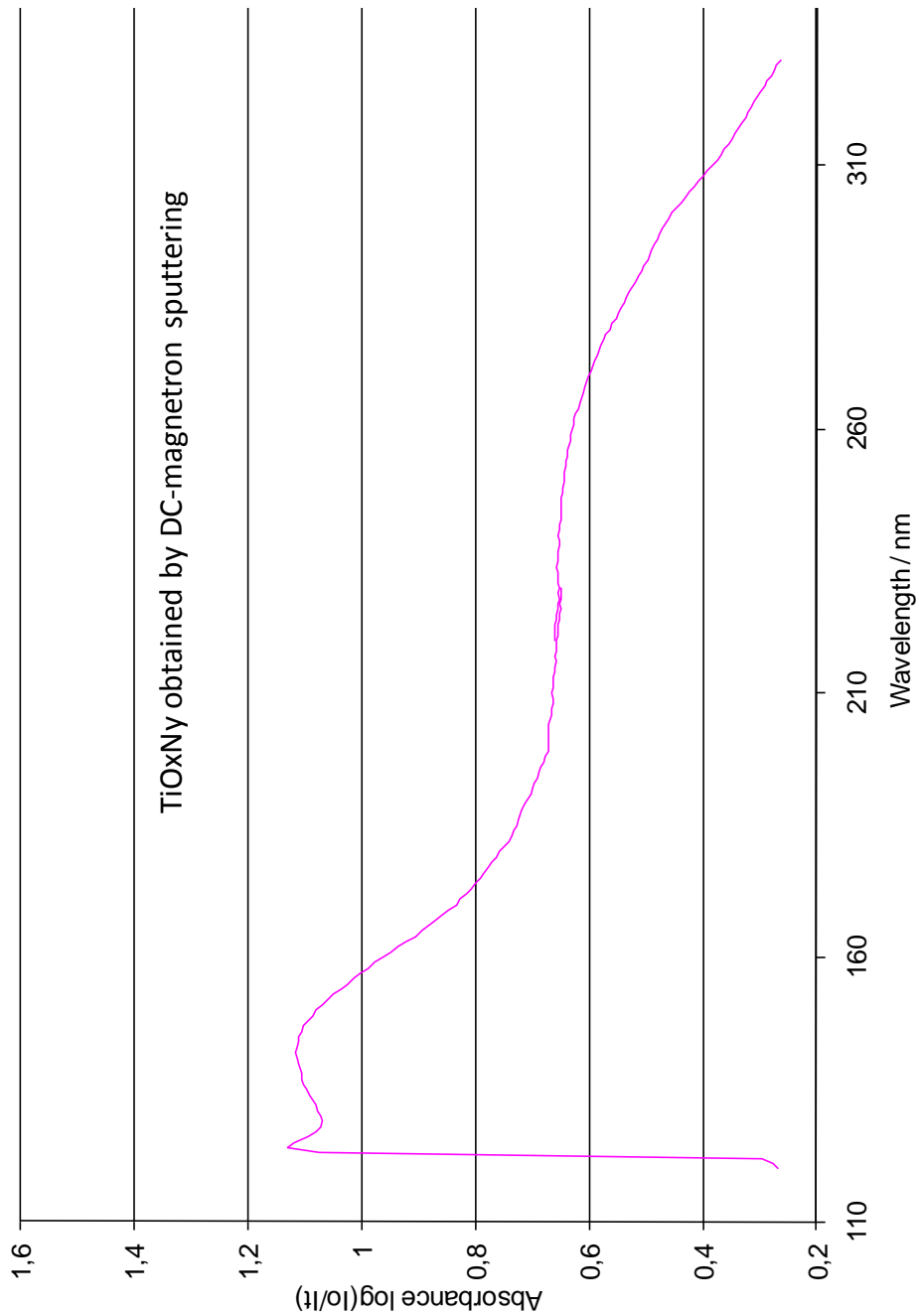


Figure 2) – High resolution VUV photoabsorption spectrum of  $\text{TiO}_x\text{N}_y$  thin film obtained by sol-gel spin coating.

