RELATING THE PLASMA OPTICAL EMISSIONS TO SIMULATION RESULTS ON THE REACTIVE SPUTTERING DEPOSITION OF TiO_2 FILMS.

F.S. Medeiros[1,2], N.F. Azevedo Neto[1], P.N. Lisboa-Filho[1], J.H.Dias da Silva[1]
[1]*Universidade Estadual Paulista, UNESP, Bauru, SP.*
[2]*Serviço Nacional de Aprendizagem Industrial, SENAI, Lençóis Paulista, SP.*

1. Introduction The film deposition by reactive magnetron sputtering has importance in both industrial and scientific research due to the versatility in preparing different materials. In order to improve the understanding of the deposition process, optical emission spectroscopy is use in order to supply information about the plasma species. In addition, different models for describing the target and substrate conditions as a function of the deposition parameters were recently developed [1,2]. In this work reactive sputtering deposition of TiO2 films was analyzed by optical emissions spectroscopy and computer simulations.

2. Experimental The films were deposited by radio frequency reactive magnetron sputtering using a metallic Ti target and Ar + O_2 atmosphere. The Ti (399.8 nm), O (777.0 nm) and Ar (750.4 nm) plasma emission lines were measured as a function of the deposition power and O_2 flow rate. The deposition regime was simulated using the RSD2013 software, based in the model by Strijckmans and Depla [2].

3. Results and Discussions The intensities of the emission lines showed a high degree of non-linearity, in special the emission from O as a function of the O_2 flow. Computer simulations were employed to simulate the O_2 partial pressure, the degree of target oxidation fraction, and the compound fraction formed at the substrate site. The results of the simulations displayed good agreement with the optical emission, in special the simulated variation of the O_2 partial pressure correlates very well to the intensity of the oxygen emission line, as a function of the O_2 flow rate. This provides a good indication that the simulation results are reliable, and allows us to use the results in the investigation of film properties and process optimization. The observed non-linearity of the oxygen partial pressure was then related to the chemical getter effect of the Ti deposits on the substrate and chamber walls. Both the optical emissions and simulation results were useful to get deeper understanding of the role of the deposition parameters during film deposition. The results were used to analyze and correlate the deposition parameters to the resulting structural and optical properties of the TiO_2 films.

References:

[1]- S.Berg and T.Nyberg, Thin Solid Films, **476**, 215-230, (2005). [2]- K.Strijckmans and Depla, J. Phys. D: Appl. Physics, **47**, 235-302, (2014).

Fabrício de Souza Medeiros: fabricio_smd@yahoo.com.br