W/W-SiCH/TaO_xN_y multinanolayers for Concentrated Solar Power

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Absorbers for concentrating solar power plants require materials that are resistant to high temperatures and spectrally selective, i.e., highly absorbent in the visible and near infrared range and low-emissive in the infrared range. To improve the absorbing power of the receivers of concentrating solar power plants, an optical end coating with high air temperature protection can be deposited on the absorbing layers. Tantalum oxynitrides, which are a good compromise between oxides and nitrides, can be used as an anti-reflective coating with high temperature protection in air deposited on an absorbing structure. These TaO_xN_y anti-reflection materials can maximize the transmission of solar radiation to a W/W-SICH bilayer which has been previously studied and ensure a good thermomechanical resistance of the coating. Work has also shown the optical feasibility of the stacking thanks to the refractive indices of the respective layers determined by ellipsometric spectroscopy.[1] For our study, these TaO_xN_y films were developed by reactive sputtering of a tantalum target in a plasma mixture of argon at a fixed flow rate, dioxygen and diazote at a variable flow rate. The RBS allowing to study their chemical composition in a more detailed approach showed compositions ranging from tantalum oxide to tantalum nitride (Fig.1). The microstructure determined by the Pair Distribution Function (PDF) revealed a mixture of phases (TaN, TaON and Ta_2O_5) and Electron Paramagnetic Resonance (EPR) allowed to observe the anisotropy of the coherence domains of the phases.

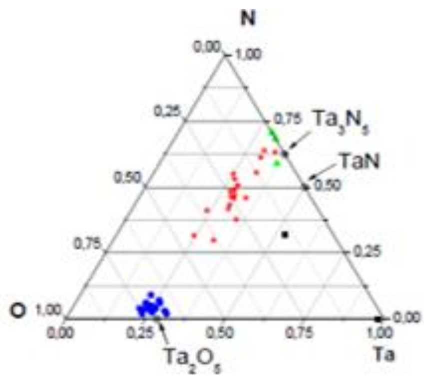

Fig. 1: Ternary diagram of the obtained films.

[1] A. Bousquet, F. Zoubian, J. Cellier, C. Taviot-Gueho, T. Sauvage, and E. Tomasella, 'Structural and ellipsometric study on tailored optical properties of tantalum oxynitride films deposited by reactive sputtering', J. Phys. D: Appl. Phys., vol. 47, no. 47, p. 475201, Nov. 2014, doi: 10.1088/0022-3727/47/47/475201.