

Characterization of transport of neutral and ionized species in reactive HiPIMS process

D. Boivin¹, A. Najah¹, C. Noel¹, R. Hugon¹, T. Belmonte¹, S. Cuynet¹, L. de Poucques¹

¹ Institut Jean Lamour, UMR 7198, CNRS, Campus ARTEM, 2 Allée André Guinier, 54000 Nancy

Mail : dimitri.boivin@univ-lorraine.fr

The aim of the study is to develop a software to control in real time the thin film deposition of a plasma magnetron process. The thin films will be obtained by HiPIMS plasma process (High Power Impulse Magnetron Sputtering) [1]. Nowadays, it is the only physical process able to ensure optimal compliance of the coatings on complex 3D substrates. It is also easy to implement on industrial production lines that are already equipped by conventional magnetron sputtering systems. In order to well understand this HiPIMS process and to control it by software, we will use three plasma diagnostics: absorption spectroscopy, mass spectrometry and optical emission spectroscopy (OES). The combination of the diagnostics will allow studying the behaviour of ions and neutrals created in the plasma and their transport in the spatial post-discharge. These measurements will serve to establish abacuses for the control software. We will also associate OES data with the conformity and properties of the coatings to verify if the latter could be linked with some OES lines, whose evolutions could be the signature of the imposed modifications.

By OES measurements, we focus our study on the influence of gas pressure, gas mixture (Ar/O₂), HiPIMS power and discharge duration with titanium target in order to find complementary results to elaborate abacuses for the control software. Figure 1 (a) shows the influence of the gas mixture on the emission line of Ti. and (b) shows the influence of discharge duration (P_{average}=70W) on the Ti emission line.

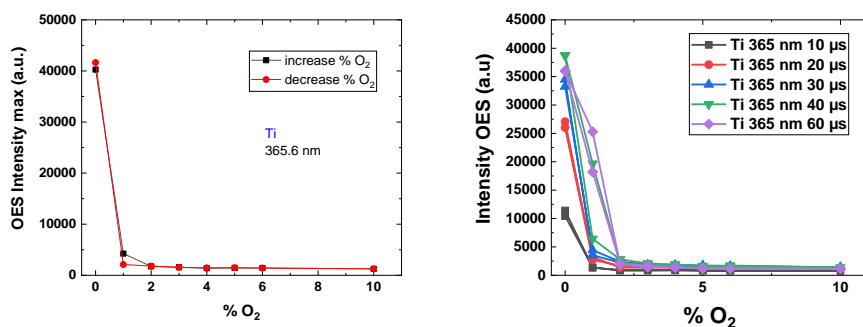


Figure.1 (a): Influence of % O₂ in the Ar/O₂ gas mixture, (b) influence of the discharge duration at 5 mTorr and Ti target (P_{HiPIMS}=70 W)

Reference:

[1] A. Anders, *Tutorial : Reactive high power impulse magnetron sputtering (r-hipims)*, Applied Physics Review **121** (2017).