Atmospheric Plasma Deposited Titanium Dioxide Thin Films: Surface and Plasma Chemistry

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Titanium dioxide (TiO_2) thin films are nowadays widely studied for their broad range of applications. Indeed, by the simple deposition of a TiO_2 thin film on a substrate new surface applications can be obtained such as water purification, surface self-cleaning etc. In order to synthesize TiO_2 thin films, the Atmospheric Pressure Plasma Chemical Vapor Deposition (APP-CVD) is a method of choice. Indeed, APP-CVD present several advantages for the deposition of metal oxide coatings. This method appears to be a viable method for the deposition of TiO_2 at a large scale thanks to its low cost of running and fast deposition rate. However in order to really bring this technology to an industrial level, the perfect comprehension of the film formation and a suitable and reliable in-line monitoring method should be investigated further.

In this work, we focus on investigating the effect of the plasma power and the composition of the plasma gas both on the thin film chemistry and the plasma chemistry. The deposited thin films compositions are assessed via X-ray Photoelectron Spectroscopy (XPS). A high plasma power is found to be responsible of the formation of high carbon-containing layers in absence of oxidizing gas in the discharge. The fine tuning of the discharge power and the gas composition enable the deposition of TiO_2 thin films with low carbon content. In order to understand the thin film growth mechanism the generated species in the discharge are observed by Optical Emission Spectroscopy (OES). OES appears to be an efficient method for the monitoring of the discharge during plasma deposition.