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Optimisation of PVD and PECVD thin film deposition on 3D objects

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Plasma assisted deposition technologies are efficient methods for developing innovative surface functionalities and adding high value to a large range of materials. Especially magnetron sputtering and Plasma Enhanced Chemical Vapor Deposition (PECVD) are widespread techniques allowing the deposition of thin films on substrates at different scales, and with various geometries from flat to 3D shapes. Ensuring a good coating homogeneity in term of thickness and properties can become difficult when considering tridimensional objects or complex surfaces with high roughnesses such as those arising from the highly expanding additive manufacturing sector. However it is a main factor of product quality for most applications involving mechanical and tribological properties, aesthetics, corrosion resistance, optical properties … The control of thin films deposition requires then a suitable understanding of the different elements involved in the deposition process, such as substrate position and movement, gas injection, pumping, cathode specificity, and their effects on the final properties.
This study aims at a better understanding of coatings characteristics obtained from magnetron sputtering and PECVD on static and moving samples, in order to prepare the implementation of such deposition processes in a large 3D vacuum coater. It is in a preliminary step based on an experimental approach at lab scale, using a specifically designed substrate holder allowing the characterization of samples placed at different positions. Thin layers of Ti, TiO_2 and SiO_2 are characterized in term of thickness, morphology and roughness. A Numerical simulation approach is furthermore considered using NASCAM (Nano SCAle Modelling) software for predicting some of the thin films properties.

Keywords
3D
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