Pulsed aerosol assisted plasma deposition: process and film composition characterization using nanoparticles optical properties

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Aerosol-assisted processes enable to deposit thin films, homogeneous[1,2] or nanocomposite[3–6]. For example, the nebulization of colloidal solutions, *i.e.* liquid solutions containing nanoparticles, in different plasma processes has been widely used for nanocomposite thin film deposition. In the case of this work, an alternative method, called reactor-injector of nanoparticles, permits to synthesize nanoparticles prior to their injection in the plasma in a pulsed injection regime[7]. It enables to form nanocomposite thin films with really small (<10 nm in diameter) and highly dispersed nanoparticles embedded in a matrix[7]. However, confined nanoparticles are often evacuated before reaching the substrate resulting in very low volume fraction of nanoparticles in the final coating.

To increase the number of nanoparticles in the plasma, it is necessary to make *in situ* measurements. This work aims to study the deposition of ZnO/DLC nanocomposite thin films in a low-pressure RF plasma, which is convenient, since ZnO nanoparticles have characteristic optical properties: absorbance at their band-gap (3.37 eV) and they fluoresce when illuminated by ultraviolet light (320-360 nm)[8–10]. These properties are dependent from nanoparticles' quantity. The more there are, the more the fluorescence and absorbance are important. This properties can be used to establish an abacus using a known quantity of nanoparticles and determine the absorbance coefficient and quantum yield of the nanoparticles.

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