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PROC / Process control (including plasma diagnostics, plasma modelling)

# Study of the influence of a substrate on the axis of the plasma discharge by Optical Emission Spectroscopy (OES)

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**Abstract content**

Currently, plasma torches find applications in a wide variety of fields such as production of thin layers, surface cleaning or even sterilization [1,2,3]. The use of plasma has a significant advantage from an environmental point of view compared to processes using liquid phases which generate effluents to be reprocessed. The device used for this study is composed of a plasma torch operating at atmospheric pressure called an “Axial Injection Torch” (or TIA for “Torche à Injection Axiale”). At IRCER, the TIA is mainly used for thin layers deposition [4] and surface treatments. In this study, the plasma jet generated by the TIA is characterized by optical emission spectroscopy in order to analyze the influence of the presence of a substrate in the axis of the discharge. This study aims to be more representative of the treatment conditions by positioning the substrate at substrate nozzle distances used for the production of thin layers or for disinfection. The first measurements carried out aimed to determine the influence of the presence of a substrate and that of the nature of the substrate in the axis of the discharge onto the excitation temperature. They were conducted for different argon plasma gas flowrates [13-17slpm], at different microwave powers [250-420 W], nozzle/substrate distances [10-30 mm] and for several types of substrate (metal, silicon, Al2O3). The results showed that the more the distance between the nozzle and the substrate decreases the more the excitation temperature increases. When a substrate is placed in the axis of the discharge, a confinement is created therefore the excitation temperature increases in the vicinity of the substrate. Excitation temperatures ranging from 7200K to 11000K were obtained, depending on the operating conditions and the nature of the substrate exposed at the plasma. To complete this study, the gas temperature was calculated with Specair software using a mathematical adjustment of the molecular band of N2 +.

**References**

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