UV-C Emitting Phosphors under Plasma Excitations: A Biocidal Effect?

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This paper presents a preliminary study in order to investigate the biocidal activity of an UV-C phosphors light emission under plasma excitation.

In this purpose, a small Dielectric Barrier Discharge (DBD) lamp prototype has been developed in collaboration with Saint Gobain Society. The design principle of this lamp is presented in figure 1 where two quartz plates are separated by a gas gap (mixture of Ne/Xe 50%). The quartz plates present the dielectric. An internal phosphor coating, calcium pyrophosphate ($Ca_2P_2O_7$) doped with Pr^{3+}, generates UV-C emissions and a conducting grid is deposited on both external sides (parallel and plane electrodes) to apply the voltage and initiate the gas discharge. The power supply can generate square or sinus waveform with frequency up to 100 kHz and a 2 kV maximum voltage.

The choice of the phosphor coating has been justified in our previous work [1] where phosphor efficiencies were compared in a dedicated experiment chamber filled with a Ne/Xe 50% mixture at 250 mbar. In these conditions, the highest temperature process (α-$Ca_2P_2O_7$:Pr 2%Na2%) was identified to be the most efficient.

The first step of this study is a parameters approach based on different excitations (waveform, frequency and power) with spectral investigations on the UV-C emission leading to the choice of a standard configuration. Once the different parameters are fixed, the biocidal effect of the UV-C emission on Escherichia coli is studied for different exposure periods and concentrations.

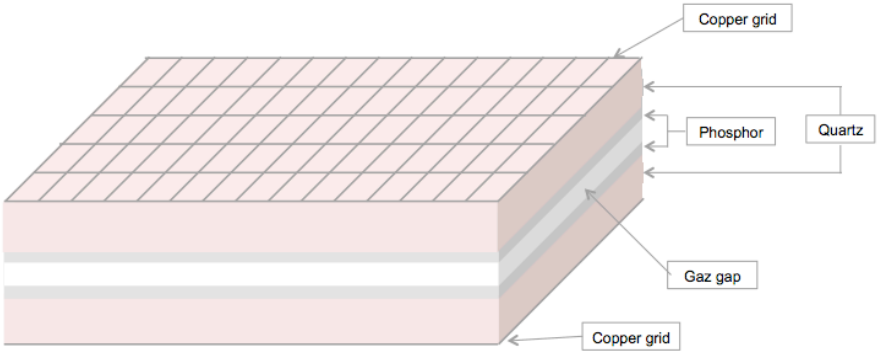

Figure 1: *The DBD lamp prototype design principle (80 mm × 120 mm ×6 mm)*

References

[1] Caiut J.M.A, Lechevallier S., Dexpert-Ghys J., Caillier B., Guillot P., Journal of Luminescence (2011), **131**, 4, 628-632.