

Optimization of the plasma parameters:

While the methodology presented in this paper was kept to a minimum as it was intended to a multidisciplinary audience, some optimization of a gliding arc prototype was done prior to the prototype presented in this paper. Figure S.1 below presents different electrode geometries which were explored.

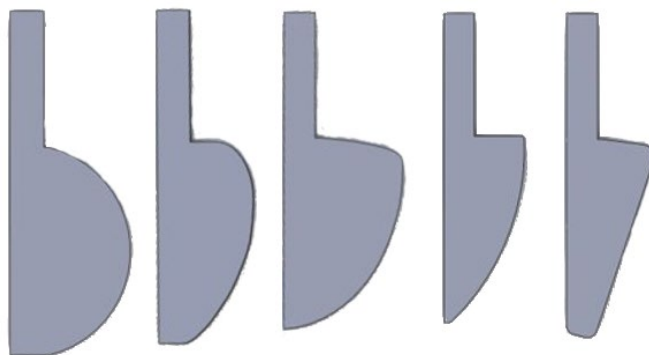
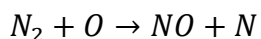


Figure S.1 Various electrode geometries for plasma optimization.

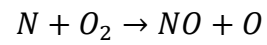
The initial parameter space of exploration included the electrode geometries presented in figure S.1, in the same configuration as in figure 2. Using the above geometries, as well as varying the inter-electrode distance, flow humidity (0 to 75 RH%), flow volume (1-10 slm), water composition (milli-Q, distilled and tap), it was possible to increase the efficiency of nitrogen incorporation (measured using Griess and Nitrite measurement) by a factor of 5-10 compared to the initial prototype.

Changing the electrode geometry, has a direct impact on the spatial distribution of thermal vs non-thermal plasma regions in the non-equilibrium plasma generated by the gliding arc. As a gliding arc is progressing, it can be categorised into 3 phases: 1) the reagent gas break-down, 2) the equilibrium heating phase and 3) the non-equilibrium reaction phase [3]. The reagent break-down phase is directly linked to the inter-electrode distance, applied voltage and gas composition. The geometry of the electrodes will have an impact on the different lengths for which phases 2 and 3 will be active, allowing to find the ideal thermal non-thermal equilibrium ratios for the generation of NO_x.

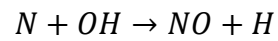
The extended Zeldovich Mechanism, formed of the following 3 reactions:



(Erreur !
Signet non
défini.1)



(Erreur !
Signet non
défini.2)



(Erreur !
Signet non
défini.3)

is responsible for the thermal generation of NO in phase 2 [31, 49]. While under phase 3, with lower temperatures only reaction (3) remains dominant, and less atomic oxygen is produced. Changing the geometry therefore has a direct impact on the chemical species present in the plasma phase.