# INVESTIGATION ON THE EFFECT OF NITROGEN COMPOUNDS ON THE OXIDATION OF SURROGATE GASEOUS FRACTION OF BIOMASS PYROLYSIS COMPOUNDS

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**Abstract**

The use of gas deriving from bio- or thermochemical conversion of biomass (i.e. biogas) for energy production occupies a relevant role in addressing several issues in the reduction of the environmental impact of the whole carbon cycle. In the framework of efficient conversion of biomass to biogas, the main problem is the very low calorific values with respect to standard fuels due to the high content of diluent. Moreover, the presence of small concentrations of nitrogen compounds could be a further issue, since these species can boost the formation of nitrogen oxides.

In this work, the oxidation of a model gas surrogate for the gaseous fraction of biomass pyrolysis products containing C1-C2 species, CO, $CO_2$ and $H_2$ was experimentally and numerically studied over a wide range of temperatures in the presence of small concentrations of $NH_3$ and NO.

The experiments were carried out in a Jet Stirred Flow Reactor. The fuel oxidation chemistry was studied for fixed dilution level of 90%, equivalence ratio of 0.8 and residence time of 0.3 s. The pressure was nearly atmospheric. The study was realized as a function of the mixture pre-heating temperature. Combustion regimes (low- and high-temperature) and instabilities were identified as a function of the temperature for the reference mixture. Therefore, to analyse the influence of nitrogenated species in fuel oxidation, the investigation was carried out doping fuel blend with NO and $NH_3$ separately. At first, the fuel mixture was doped with 225 and 380 ppm of NO. For the second experimental campaign, fuel mixture was seeded with 5 and 7% (by mole) of $NH_3$. The results showed that the onset of reactivity for the biogas mixture is at around 950 K, while doping the mixture with NO promotes the reactivity, shifting the onset of ignition of about 100 K. Also for the mixtures doped with $NH_3$, a slightly promoting effect was observed, since the onset of ignition of is anticipated of about 40 K. The obtained experimental data were simulated with a detailed kinetic model. The simulations showed that the selected model was in reasonable agreement with the present experimental data.