

Hydrogen production from CH₄ and NO treatment with non thermal plasma

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ABSTRACT

In this project chemical kinetics model and its experimental demonstration to produce hydrogen from NO and CH₄ treatment with a dielectric discharge barrier is proposed.

The research was carried out in 2 phases: The first was the analysis of simulation degradation of NO and CH₄. The second step was the development of the experimental methodology to treat the mixture (NO and CH₄).

To produce the non-thermal plasma, an AC power source was developed. This energy source works with a high frequency series resonant inverter in the range of 20 kHz to 180 kHz, able to generate a voltage of 15 kV. The discharge can be sustained at atmospheric pressure. The experimental conditions of this special case were: 36V, 2-5A and 160 kHz.

Chemical model elucidates the degradation of NO and CH₄, however theoretical results concerning hydrogen production are overestimated when they are compared to experimental results; therefore a set of additional equations are then proposed. Results obtained from the model, illustrate that in a mixture of NO in humid air, the main path for the NO removal is the oxidation to NO₂ and, soon after, to HNO₃. Concerning the diminution of CH₄ the electron impact reactions are crucial.

Keywords: Hydrogen, non-thermal plasma, toxic gases treatment

