

BEP Proposal: Towards Cleaner Industrial Combustion - How to Reduce the Formation of Pollutants in an Industrial Furnace by Oxygen Injection?

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The reduction of toxic flue gasses from industrial furnaces is at the heart of the European Commission's agenda for a more sustainable future. Results published in the scientific literature have shown that in particular cases the amount of pollutants can be reduced by injecting pure oxygen into the furnace [1]. The objective of this study is to investigate to what extent this technique can be fruitful to our industrial partner. This partner operates various ovens for the production of special purpose cement for niche applications.

We consider an industrial furnace fired by the combustion of natural gas. The chemical reaction of the gas and oxygen mixture releases heat and side products such as water and carbon monoxide. The combustion also produces undesired nitrogen oxides (NO_x). The goal here is to investigate how this formation of NO_x can be counteracted for by the injection of pure oxygen. Questions such as the quantify of oxygen and the location of the injection points can be looked into.

We foresee the following project stages:

- Stage A: develop system of ordinary differential equations for the combustion of the fuel/oxidizer mixture.
- Stage B: include formation on NO_x
- Stage C: develop compartmental model for different locations in the oven (near burner, middle section and near outlet)
- Stage D: include pure oxygen injection and investigate various amounts of injections and location

References

- [1] A.W. Date. *Analytic Combustion: With Thermodynamics, Chemical Kinetics and Mass Transfer*. Cambridge University Press, 2011.