BURNERS, COMBUSTION AND HEAT TRANSFER

(592) - PILOT TESTING AND NUMERICAL SIMULATIONS OF THE MULTIFUEL BURNER FOR THE CEMENT KILN

Jarosław Hercog (Poland)[1]; Robert Lewtak (Poland)[1]; Valter Domingos Tavares (Portugal)[2]; Angela Maria Nunes (Portugal)[2]; Daniela Gaspar (Portugal)[2]; Beata Glot (Poland)[1]; Grzegorz Nehring (Poland)[1]

1 - Institute of Power Engineering, Thermal Processes Department, Mory 8 Street, 01-330 Warsaw, Poland; 2 - SECIL SA, Estrada do Outão, Setúbal 2901-182, Portugal

Draft Paper

Rotatory kilns fed with fossil fuels, which are widely used in cement industry, are responsible for significant CO_2 emissions to atmosphere, increasing the pressure to environment. Substantial energy consumption associated to the cement production process lead to significant environmental and economical footprint in Europe and beyond, thus measures for reducing fossil fuel usage and decreasing an environmental impact are sought. One of the implemented measures is the substitution of the typical fossil fuel used in the kilns (coal and petcoke) by alternative fuels, such as biomass, RDF, sewage sludge or MSW to hinder emissions, address the circular economy goals and decrease the production costs.

This study presents the results of the laboratory and numerical investigation of the 1MW pilot multifuel burner dedicated for cement kilns which employs the possibility to co-fire petcoke (as a base fuel) with alternative fuels such as MSW, biomass and hydrogen.

The burner model was tested in the combustion facility installed at the laboratory of the Institute of Power Engineering to assess the possibility to co-fire petcoke with an alternative fuel at the as high as possible ratio.

For that task, the steady state CFD model that covers turbulent gas flow, heat transfer through convection, conduction and radiation, and multistep combustion reactions set has been created, and the 3D numerical simulations of the burner and the combustion facility were performed to validate the combustion model allowing the assessment of the burner design modifications on the combustion characteristics of the different alternative fuels in the cement kiln burner.

The main focus of this research was to reveal the impact of substituting fossil fuel with alternative fuels on the flame stability and shape, heat transfer, temperature distribution and emissions levels at different operating conditions such as fuel share, air-to-fuel ratio and air distribution.

The results showed that it is possible to co-fire a high share of the alternative fuels in the rotary kiln without the negative effects on the combustion performance.

The study was carried out within the RETROFEED project under financial support of the European Union's Horizon 2020 research and innovation programme under grant agreement No 869939.

Palavras-chave : CFD modelling, cement kiln, burner testing, alternative fuels