MODELLING OF FURNACES AND COMBUSTION SYSTEMS

(675) - (*) - NUMERICAL MODELLING OF AN INDUSTRIAL ROTARY KILN

Senthilathiban Swaminathan (Austria)[1,2]; Christoph Spijker (Austria)[2]; Markus Gruber (Austria)[3]; Irmela Kofler (Austria)[1]; Harald Raupenstrauch (Austria)[2]

1 - K1-MET GmbH; 2 - Montanuniversity Leoben; 3 - RHI Magnesita GmbH

Draft Paper

Rotary Kilns are used in the pyro processing of magnesia ore which is further used in the production of refractory bricks for the cement industry. In this paper, we present a three-dimensional numerical model that is being developed to investigate and optimize the performance of an industrial scale rotary kiln. The currently available numerical models either use a 2D geometry or a small-scale pilot kiln with the Euler Lagrange approach. Since the Euler Lagrange approach consumes enormous computation time considering the millions of particles present inside the rotary kiln, as an alternative method, a steady-state Euler-Euler multiphase model will be developed with ANSYS Fluent modelling software and will be analysed on a rotary kiln of length 100 m. To model the turbulent combustion of natural gas and air from a non-premixed burner, a species transport model was implemented with four reactions and six species Jones Lindstedt kinetics mechanism. To model the heating up of Magnesite and Dolomite particles, Thermogravimetric analysis (TGA) of the particles was carried out and mass loss of the particles will be implemented as sub-models based on the TGA curves. Sub-models for heat transfer through the walls which are covered with different layers of refractory bricks, heat exchange between the gaseous phase and the particle phase and interaction between the particles are currently being developed. The developed numerical model will be validated with the measured concentration of exhaust gases and experimental data from the kiln.

Palavras-chave : turbulent combustion, multiphase, CFD, rotary kiln