INFLUENCE OF TURBULENCE MODEL AND EROSIVE WEAR OF BURNERS ON FLAME DEFORMATION IN ROTARY KILN CHAMBER

Wydrych Jacek[1], Kaźmierczak Sławomir[2]
[1]*Department of Thermal Engineering and Industrial Facilities, Opole University of Technology, Opole, Poland*
[2]*Cement Factory WARTA S.A., Dzialoszyn, Poland*

Abstract Damage reasons of the rotary kiln of pulverized coal burners conveying pipe is related with many reasons. This paper analyses the numerical simulation of the gas-solid two-phase flow field in the coal channels of pulverized coal burners in burner with eroded wall material. For calculation was used few turbulence models and Lagrangian discrete phase model [1,2,4]. Results compares combustion conditions in the two-phase flow characteristics and particle trajectory model under different erosive wear distribution and for different turbulent models. Calculations was made for three different shapes of burner as a result of erosive wear. For that geometries was calculated combustion in rotary kiln, and estimated shape of flame in kiln chamber. Was find that the erosion rate is important for combustion in rotary kiln, and find that suggested method of calculation was proper for this subject.

Rotary kilns are the key equipments used to produce clinker in cement industry. For optimization of kiln, it is necessary to understand the detailed processes that take place in the kiln [5]. Integral part of rotary kiln is fuel burner, which surface is often subjected to erosion, especially by hard dusts. Under influence of coal particles erosive wear of burners make impossible proper combustion in kiln chamber. The burner is an important piece of equipment on any kiln installation, and it must meet the demanding requirements of many different processes such as lime recovery, cement, magnesite, kaolin, and a wide variety of other materials. The specific requirements of these processes in designing the burner system and provides a burner design that will deliver efficient and reliable combustion [3]. Even for a given process, wide variations in production, fuel types, and material properties may require different flame shapes to optimize material processing. It is possible to get more insight, such as the gas-solid flow rates, temperature, and composition of gases and particles within a rotary kiln through mathematical modeling. However, only few expressions have existed so far for the processes in a cement rotary kiln to model the fuel combustion, heat transfer, and clinker chemistry. This is owing to the complexity of heat transfer that takes place simultaneously along with chemical and mineralogical reactions. Moreover, the onsite measurements for the detailed physical parameters are complicated and are not possible in many cases. CFD predictions for cement rotary kilns including flame modeling, heat transfer, and clinker chemistry were made with use comprehensive model for most of the processes occurring in a cement rotary kiln.

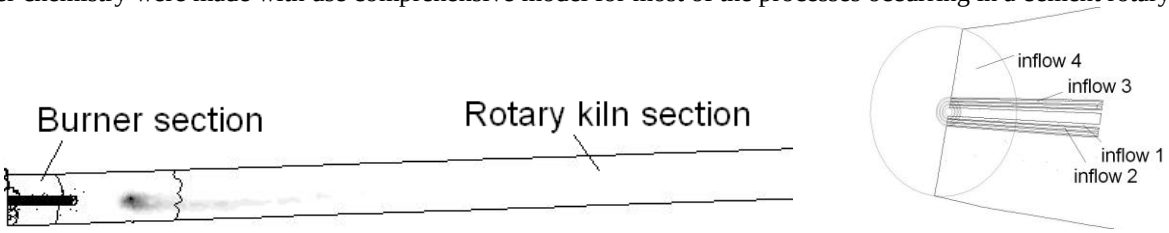

Figure 1 Lime kiln geometry with rotary and burner section (details on the right)

Beyond the problem of erosive wear this paper shows influence different models of turbulence on flame deformation in kiln chamber.
This paper presents calculation results applied to determination of burners' construction for shape of flame in kiln chamber. Numerical simulation of the gas-solid two-phase flow field in the coal channels of pulverized coal burners was made with use k-ε turbulence model and Lagrangian discrete phase model, and compares combustion conditions in the two-phase flow characteristics and particle trajectory model under different erosive wear distribution [6]. Different geometries simulate different burners shapes as a result of erosive wear. Calculations was made for three different burner geometries, for two flow conditions and for three different turbulence models.

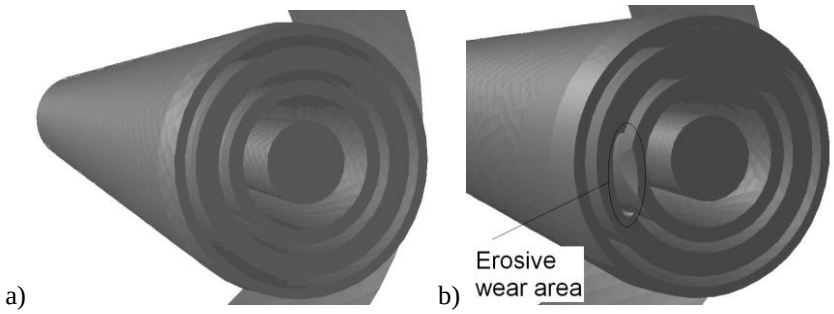

Figure 2 Shapes of burners: normal (new) and after erosive wear on one side

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