HYDRODYNAMICS AND HEAT TRANSFER OF SUSPENDED SURFACE IN A SUPERCRITICAL CFB FURNACE

Leming Cheng, Institute for Thermal Power Engineering, Zhejiang University, China
E-mail: lemingc@zju.edu.cn
Linjie Xu, Institute for Thermal Power Engineering, Zhejiang University, China
Qinhui Wang, Institute for Thermal Power Engineering, Zhejiang University, China
Mengxiang Fang, Institute for Thermal Power Engineering, Zhejiang University, China
Zhongyang Luo, Institute for Thermal Power Engineering, Zhejiang University, China
Mingjiang Ni, Institute for Thermal Power Engineering, Zhejiang University, China
Kefa Cen, Institute for Thermal Power Engineering, Zhejiang University, China

With the scaling-up of CFB boilers, more heating surfaces like suspended surfaces and/or mid-partition walls, are arranged in the furnace to ensure adequate heat absorption. The length of suspended surface reaches almost half height of the furnace in the Baima 600MW supercritical CFB boiler. Since the gas-solids hydrodynamics and heat transfer on those surfaces are different from that on waterwall, further researches are needed to investigate the characteristics of hydrodynamics and heat transfer on the suspended surfaces. Beside the experimental measurements on the suspended surfaces in a scale down test rig, the hydrodynamic characteristics on the suspended surfaces were computed by a CFD simulation combined with EMMS model in a supercritical CFB of annular furnace. The results present an uneven axial solid concentration profile on the suspended surface, and descending particles are found on some locations especially where those surfaces far away from the furnace exits.

Based on the gas-solids hydrodynamic results, the modified cluster renewal model was applied in the heat transfer coefficient calculation of the suspended surfaces. The result shows the heat transfer coefficient varies with the height and it has difference between two sides of a surface. In addition, the average heat transfer coefficients of suspended surface at different locations are compared.

References

Basu P, Nag P K. Heat transfer to walls of a circulating fluidized-bed furnace[J]. Chemical Engineering Science, 1996, 51(1): 1-26.

Cen K F, Ni M J, Luo Z Y, et al. Theoretical design and operation of circulating fluidized bed boiler[J]. China Electric Power Press, Beijing, 1998: 647-663.

Cheng L M, Wang Q H, Shi Z L, et al. Heat transfer in a large circulating fluidized bed boiler[J]. Journal of Power Engineering, 2006, 26(3): 305-310.

Huang C, Cheng L M, Zhou X L, et al. Suspended surface heat transfer in a large circulating fluidized bed boiler furnace[J]. Journal of Zhejiang University. Engineering Science, 2012, 46(11): 2128-2132.

Sundaresan R, Kolar A K. Axial heat transfer correlations in a circulating fluidized bed riser[J]. Applied Thermal Engineering, 2012.

* “Strategic Priority Research Program” of the Chinese Academy of Sciences, Grant No. XDA07030100