

热能工程

循环流化床锅炉燃烧福建无烟煤炉内脱硫的工业试验研究

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摘要: 为检验针对于燃烧福建无烟煤的循环流化床(circulating fluidized bed, CFB)锅炉炉内脱硫效果、获得同时满足高效脱硫和高效燃尽要求的最佳运行参数, 在一台75 t/h的工业热态循环流化床锅炉上进行了炉内添加石灰石脱硫试验, 研究钙硫比、床温、二次风率、脱硫剂粒径等对燃烧福建无烟煤CFB锅炉炉内脱硫效果的影响, 以及脱硫对锅炉氮氧化物排放、飞灰含碳量等的影响。试验表明: 添加石灰石后, 烟气中SO₂的排放浓度迅速下降, 而后随着时间的推移在一定水平上小幅度的波动变化, 振荡下降。脱硫效率随着[Ca]/[S]比的增大而提高。但当钙硫比小于2.4和大于4.1时, 脱硫效率随钙硫比的变化不明显; 脱硫效率随[Ca]/[S]比呈“S”型曲线规律变化, 炉内脱硫存在有一个最佳[Ca]/[S]比。石灰石的平均颗粒粒径越细, 炉内燃烧脱硫效率越高; 随着炉床温度的上升, 脱硫效率呈线性下降。脱硫效率随着二次风率的提高先缓慢增大, 而后急剧下降, 呈开口向下的抛物线分布特征, 存在有一个最佳的二次风率。炉内添加石灰石脱硫对锅炉氮氧化物排放的影响很微弱; 随着钙硫比的增加, NO_x的排放浓度有轻微的下降。飞灰烧失量随着[Ca]/[S]比的增加而下降, 但当[Ca]/[S]比大于3.5后, 飞灰烧失量不再随[Ca]/[S]比的变化而变化。

关键词: 循环流化床锅炉 福建无烟煤 炉内脱硫 工业试验

An Industrial Experiment Research on the Desulfurization of Circulating Fluidized Bed Boiler Burning Fujian Anthracite

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Abstract: In order to get some experiences of combustion desulfurization for those circulating fluidized bed boilers burning Fujian anthracite, an industrial experiment was conducted on a 75 t/h circulating fluidized bed (CFB) boiler burning Fujian anthracite. Using limestone as desulfurizing agent, the effects of the variation of [Ca]/[S] (ratio in mol), mean sizes of limestone particle, bed temperature, and secondary air ratio on the boiler's desulfurization efficiency were tested, and the effect of desulfurization on the carbon content in fly ash and the NO_x emission of boiler was also studied. The experiment shows that: The SO₂ emission in flue gas decrease rapidly after limestone is added, then fluctuated with time and drops in an oscillation way. The desulfurization efficiency increase with the rise of [Ca]/[S] molar ratio, but it increases slowly when [Ca]/[S]<2.4 or [Ca]/[S]>4.1. The variation of the desulfurization efficiency with the [Ca]/[S] molar ratio could be described with an "S" curve; Under a definite boiler operation condition, it exists an optimal [Ca]/[S] molar ratio. The desulfurization efficiency decreases in a quasi-linearly way with the rise of bed temperature, and increases with the decrease of the mean size of limestone particle. The variation of the desulfurization efficiency with the secondary air ratio could be described in a concave downward parabolic curve; with the rise of secondary air ratio, the desulfurization efficiency increases slowly in the early stage, and then decreases rapidly in the late stage. Under a definite desulfurization operation condition, it exists an optimal secondary air ratio. The desulfurization during combustion has no evident effect on the NO_x emission of boiler, with the rise of [Ca]/[S] ratio, the NO_x emission decreases slightly. The carbon content in fly ash decline with the rise of [Ca]/[S] molar ratio, however, when [Ca]/[S] is big enough (such as>3.5), the loss of ignition (LOI) of fly ash would no longer change with the [Ca]/[S] mol ratio.

Keywords: circulating fluidized bed boiler Fujian anthracite combustion desulphurization industrial experiment

收稿日期 2010-04-26 修回日期 2010-09-07 网络版发布日期 2010-12-22

DOI:

基金项目:

福建省科技计划重点项目资助(2006H0088); 福建省科技创新平台项目资助(2009H2006); 集美大学创新团队基金资助(2009A002)。

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