

发电

粉煤和石灰石加入位置对循环流化床燃煤过程NO_x与N₂O排放的影响

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摘要:

在30kW的循环流化床(CFB)上进行3种煤的燃烧实验, 考察了粉煤和脱硫剂加入位置、分级燃烧以及空气过剩系数对NO_x和N₂O排放的影响。所采用的CFB燃煤系统由提升管和下行床构成, 提升管主要用于粉煤燃烧, 下行床主要用于固体床料循环和粉煤热解。粉煤或脱硫剂分别自传统的一次空气布风板上方和下行床上部两个位置加入。结果表明, 在不加脱硫剂的条件下, 降低空气过剩系数和一次空气化学计量比均可有效降低NO排放, 但对N₂O排放则呈现上升、下降和无明显变化多种趋势。当粉煤加入位置自传统的提升管下部改变到下行床上部时, 减少空气过剩系数或减少一次空气化学计量比可明显降低其中两种煤的NO排放, 并可少量降低另一种煤N₂O的排放; 从下行床加入粉煤时, 空气分级和低O₂燃烧对NO排放的影响程度有所减弱。最后, 对一种煤进行了脱硫实验, 随Ca/S摩尔比的升高, SO₂排放显著降低, NO排放升高, 而N₂O则先上升后下降; 且自下行床加入时, NO排放更低; CaCO₃加入位置变化对N₂O排放无明显影响。

关键词: 热能动力工程 煤燃烧 循环流化床 加入位置 NO N₂O

Effect of Coal and Limestone Addition Position on Emission of NO_x and N₂O during Coal Combustion in a Circulating Fluidized Bed Combustor

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Abstract:

The effects of coal and limestone addition at different positions on NO_x and N₂O emissions from a 30kW scale coal-fired circulating fluidized bed (CFB) were investigated. Both staging combustion and excess air number were studied in this paper. Three coals from western China were applied. The CFB combustor consists of a riser and a downer, which the riser was designed as coal combustor and the downer was used to the circulation of solid material and coal pyrolysis. Two addition port of were adopted for coal or limestone in this study, which was located 20mm above the primary air distributor in the riser and the other was at the upper of the downer. The results show that, without limestone addition Port, coal being injected through the two addition port, reducing first air stoichiometry or excess air number always results in the decrease of NO emissions for the three coals. However, its effects on N₂O emissions are not uniform. With the increase of excess air number, N₂O emissions increase, decrease and no obvious variation all can be observed. And the effects of air staging on N₂O emissions are not obvious. The switch of coal addition port from the riser to the downer, always but not ever, leads to the reduction of NO emissions, but its effect on N₂O emissions is much smaller. The effects of the first air stoichiometry and excess air number on NO emissions, compared with being added into the riser, will be weaken when coals were added into the downer. One of the three coals was adopted to investigate the influence of limestone on emissions of SO₂ and nitrogen oxides. The results show that SO₂ emissions decrease, NO emissions increase and N₂O emissions firstly increase slightly and then decrease with the increase of Ca/S molar ratio. Compared with being added into the riser, the limestone added into the downer can result in a smaller increase of NO emissions. However, the switch of limestone addition port has no significant effect on N₂O emissions.

Keywords: thermal power engineering coal combustion circulating fluidized bed coal addition position NO N₂O

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