

75 t/h 烟煤锅炉改烧无烟煤

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摘要: 一台燃用烟煤的 75 t/h 锅炉改为燃用无烟煤, 通过重新设计布置燃烧器, 并实施其它相关改造, 取得了改造后锅炉燃用无烟煤 60% 负荷下不投油能稳燃的良好效果。

关键词: 锅炉; 燃烧稳定性; 粉煤燃烧; 稳燃腔燃烧器

中图分类号: TK223.2 文献标识码: A

1 前言

惠城发电厂 1 号炉是 75 t/h 固态排渣、中间仓储式热风送粉煤粉锅炉, 设计煤种为烟煤, 燃烧器四角布置切向燃烧, 炉膛断面尺寸为 5.81 m × 5.81 m。自发电以来, 锅炉一直燃用热值为 21 000 kJ/kg 左右的大同烟煤。由于烟煤价格较高, 造成发电成本较高, 为此将燃用煤种改用当地价格便宜的无烟煤。

为了给锅炉改造方案的确立提供可靠的依据, 在锅炉改造前进行了一次冷态试验, 摸清了锅炉炉内空气动力场情况, 以及燃烧器实际的安装布置情况, 认为: 炉内实际切圆偏小, 如果改用无烟煤, 燃烧器必须重新设计并减小粉管的尺寸等。通过一系列的改造, 达到了改造目的。

2 燃煤特性分析

大同烟煤与当地无烟煤煤质特性元素分析如表 1 所示。

表 1 煤质特性元素成分分析(%)

	C_{ar}	H_{ar}	O_{ar}	N_{ar}	S_{ar}	A_{ar}	M_{ar}	V_{daf}	$Q_{ar.net}/kJ \cdot kg^{-1}$
烟煤	55.66	3.69	8.64	0.89	0.91	22.39	8.0	38.07	21 623
无烟煤	58.6	0.7	2.21	0.54	0.76	28.39	8.8	6.83	19 887

利用文献[1]提供的方法, 对表 1 中的煤种进行着火稳定性指数 V 和燃尽性指数 S 计算判别, $V = 12.25 \ln V_{daf} - 21.98$, $S = 1.06 \exp(0.0267V_{daf})$, 计算

判别结果如下:

烟煤: $V = 22.6$ $S = 2.93$ 属易稳定和易燃尽煤种;

无烟煤: $V = 1.56$ $S = 1.27$ 属极难稳定和极难燃尽煤种。

从上述计算可知, 改造前后的煤质将发生极大变化, 为了达到改造目的, 不仅要采用稳燃性能很好的燃烧器, 以强化着火和稳定燃烧, 而且还必须对炉内安装切圆、卫燃带、一次风粉管以及运行时的制粉系统、一二次风的分配等等方面进行调整和改造。关于稳燃腔煤粉燃烧器的原理结构及其试验研究应用在文献[2~4]中有详细的介绍总结, 本文重点介绍改造实验方案及改造效果。

3 改造实验及方案

为了确立合理的实施改造方案, 在改造前进行了炉内空气动力场试验。试验结果发现, 相对于炉膛尺寸, 实际燃烧切圆直径仅为 0.25 ~ 0.30 (如图 1 所示), 火焰中心偏向左墙。炉内几乎不存在无风区, 气流旋转较弱。试验结果说明燃烧稳定性较差, 实际运行表明, 煤质稍

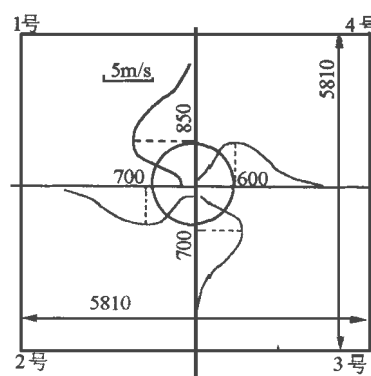


图 1 改造前炉内速度场分布

差, 锅炉则难以稳定运行。飘带试验基本与用热球风速仪测量一致。在试验时还发现, 在平时运行时, 二次风量较小, 一次风偏大, 对稳定燃烧及煤粉的燃尽

是不利的。通过冷态试验,确立改造方案如下:

(1) 调整燃烧器的安装切圆,由原设计的 $\Phi 480$ mm改为 $\Phi 550$ mm,以增大炉内实际切圆,增强燃烧稳定性;

(2) 燃烧器重新设计布置,采用稳燃腔煤粉燃烧器,以改善煤粉的着火条件,提高燃烧稳定性;

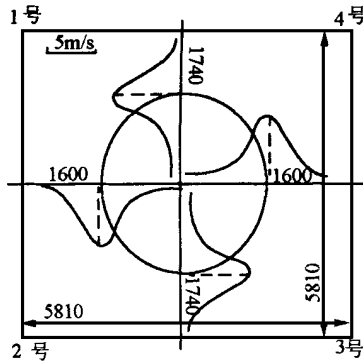


图2 改造后炉内速度场分布

一次风率可较大一些,燃烧贫煤或无烟煤,一次风率一定不能大。一次风率越大,煤粉着火时间相对越晚,燃烧越不稳定。对高浓度煤粉燃烧的研究表明^[5],煤质越差,煤粉浓度值相对要求越高,以便使煤粉提前着火,稳定燃烧;

(4) 增加 20 m^2 的卫燃带,以提高炉内燃烧温度,增强燃烧稳定性;

(5) 调整粗粉分离器挡板,减小 R_{90} ,使煤粉较容易着火及燃尽,以适应烧无烟煤的要求;并改造了给粉机,以提高下粉的均匀性。

4 改造效果

对1号炉进行上述改造后进行了炉内冷态空

(3) 粉管改小,较大的粉管会造成诸多不利燃烧因素,一是由于煤质变差,要输送煤粉并保证不堵粉,必须用较大的输送速度,必然导致一次风量增大,一次风率加大。对燃烧来讲,一次风率的大小是非常关键的,一般来讲,燃烧烟煤,

气动力场试验。结果表明,炉内气流切圆大小、位置、气流的旋转强度都很好,气流也无贴墙现象,实际燃烧切圆直径为 $0.55\sim 0.60$ (如图2所示)。锅炉运行证明,改造非常成功,体现在:(1)燃烧很稳定,基本上是负压运行,在看火孔观察发现,煤粉从喷口一进入炉膛,便迅速着火,燃烧是稳定的,炉内没有朝外面冒粉,火焰较亮,炉内的温度水平较高,约 $1300\text{ }^\circ\text{C}$,炉膛出口处的温度约为 $960\text{ }^\circ\text{C}$ 。在表1煤质下,热效率试验结果表明,飞灰含碳量为 9.55% ,锅炉效率为 87.05% ,比改前还提高约 1% 。(2)低负荷试验表明,1号炉在负荷为 60% 时,燃烧稳定,不用投油助燃,主蒸汽温度为 $420\text{ }^\circ\text{C}$,主蒸汽压力为 3.3 MPa ,炉膛出口温度为 $860\text{ }^\circ\text{C}$ 左右。

表2 1号炉实际燃煤工业分析(%)

FC_{ad}	V_{ad}	A_{ad}	M_{ad}	M_{ar}	$Q_{as,net}$
68.39	5.23	24.12	2.26	9.1	22 200 kJ/kg

通过一系列的改造,成功地实现了由烧烟煤改烧无烟煤,大大降低了发电成本,取得了可观的经济效益。

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(复 编辑)

layer in a circulating fluidized bed boiler serving as an object under investigation a simulation study has been conducted. The results of the study indicate that the proposed system features a good robustness and a high anti-interference ability with respect to the error of the model. **Key words:** neural network, internal model control, circulating fluidized bed boiler

75 t/h 烟煤锅炉改烧无烟煤 = **The Modification of a 75 t/h Bituminous Coal-fired Boiler for Adaptation to Burning Anthracite Coal** [刊, 汉] / CHEN Gang, QIU Ji-hua, LI Fu-jin (Huazhong University of Science & Technology, Wuhan, Hubei, China, Post Code: 430074) // Journal of Engineering for Thermal Energy & Power. — 2000, 15(4). — 432 ~ 433

Through a renewed design and layout of its burners a 75 t/h bituminous coal-fired boiler has undergone a technical modification for adaptation to operating on anthracite coal. Coupled with other relevant structural changes the modified boiler has achieved a stable combustion regime at 60% of rated load without resorting to fuel oil for combustion support when operating on anthracite. **Key words:** boiler, burner with a stable combustion cavity, combustion stability, pulverized-coal burning

某进口船用燃气轮机滑油代用品试验分析 = **Experimental Analysis of a Replacement for Imported Lub Oil Used for a Marine Gas Turbine** [刊, 汉] / SUN Xiang-long (Harbin No. 703 Research Institute, Harbin, China, Post Code: 150036) // Journal of Engineering for Thermal Energy & Power. — 2000, 15(4). — 434 ~ 435

Performance tests were performed of a Chinese-made lub oil (HP-8AGB439-90) for aircraft jet engines with regard to such a variety of properties as resistance to oxidation corrosion and lubricating capacity, evaporation function, foam generation, and absence of any undesirable influence to rubber, etc. The above-cited lub oil was also compared with an imported one in respect of quality. Its use and test for a duration of 150 hours on an imported gas turbine engine have shown highly promising results, testifying to the fact that it can well be used to replace the imported marine lub oil (ГОСТ 1028999-79). **Key words:** lub oil, test, physical and chemical index, analysis

可调整抽汽投入方法的探讨及实践 = **An Exploratory Study of the Method for Putting into Operation an Adjustable Steam Extraction and Its Practical Use** [刊, 汉] / TIAN Feng, YU Tian-long, SU Lei-tao (Guangdong Provincial Electrical Power Test Research Institute, Guangzhou, China, Post Code: 510600) // Journal of Engineering for Thermal Energy & Power. — 2000, 15(4). — 436 ~ 438, 441

An analysis was conducted of the construction features and operating principles of some typical types of adjustable turbine extraction method currently in use in the People's Republic of China. Discussed and explored in detail were the phenomena involved in the steam extraction process and the methods for putting into operation the steam extraction. Moreover, the authors have proposed an accurate and scientific method for putting into operation the steam extraction, which turned out to be highly effective in practical use. The information reported in the present paper can serve as a guide for dealing with problems and difficulties prevalent in China concerning the implementation of an adjustable steam extraction. **Key words:** steam turbine, regulation system, pressure adjustment system, adjustable steam extraction

对燃油锅炉渣油供油系统的工艺改进 = **Technological Improvement of a Residual Oil Supply System for an Oil-fired Boiler** [刊, 汉] / JIN Jing-hua (Shenzhong Community Thermal Energy Management Section of Shandong Provincial Dongyin Shengli Oil Field, Dongyin, Shandong, China, Post Code: 257000) // Journal of Engineering for Thermal Energy & Power. — 2000, 15(4). — 439 ~ 441

Proposed in this paper are a series of effective measures aimed at improving the residual oil supply system of oil-fired boilers and resolving some commonly occurring problems related to the burning of residual oil in such boilers. **Key words:** oil-fired boiler, residual oil, oil supply system, technological improvement