

# 300 MW 机组双进双出磨煤机分离器改造优化

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**摘要:** 石家庄良村热电有限公司 300 MW 机组锅炉采用 MGS4062 型双进双出磨煤机, 随着煤质的下降和入炉煤杂物的增多, 配套的径向挡板型分离器存在严重堵塞问题, 影响机组带负荷能力。通过将分离器改造为双级轴向型, 并在出粉口和回粉斜管上加装杂物过滤装置, 实现磨煤机正常出力条件下煤粉均匀性指数  $\geq 1$ , 磨煤单耗下降 12.2%, 磨煤机出力提高 36% 以上; 同时, 煤粉中的杂物能被过滤和清理出来, 避免堵塞一次风管和锁气器。

**关键词:** 双进双出磨煤机; 堵塞; 双级轴向分离; 杂物过滤装置; 磨煤单耗

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## 0 引言

磨煤机径向分离器具有分离效果差、容积利用率低、阻力大、均匀性差、循环倍率高等缺点<sup>[1-2]</sup>, 且由于折向挡板排列紧密, 原煤中混有的秸秆、布条、绳线等杂物经常缠绕在挡板叶片上, 堵塞流通通道, 造成回粉不畅或不回粉, 影响磨煤机出力和煤粉均匀性。分离器堵塞后只能靠定期停运磨煤机来进行人工清理, 工作量大且影响机组连续带负荷能力。

石家庄良村热电有限公司 300 MW 机组每台锅炉配备 3 台 MGS4062 型双进双出磨煤机, 配套分离器为静态径向挡板型。由于煤质下降和入炉煤中杂物增多, 径向挡板频繁发生堵塞, 导致分离器阻力增加、磨煤单耗升高、磨煤机出力降低、煤粉均匀性变差等一系列问题, 且每隔一段时间必须停运磨煤机对分离器挡板进行杂物清理。同时, 该厂入炉煤中夹带有大量的树枝、杂草、编织袋、塑料袋等轻质杂物, 其中能够通过轴向挡板的杂物会进入一次风管, 堵塞在一次风喷口的浓淡分离器挡板及加强筋上, 造成一次风堵管, 严重时造成一次风喷口烧毁; 而未通过轴向挡板的杂物则进入回粉管, 堵塞锁气器<sup>[3]</sup>。

为解决上述问题, 拟将静态径向分离器改造为双级轴向型分离器<sup>[4]</sup>, 以增加制粉系统出力; 同时, 在出粉口和回粉斜管内加装杂物过滤装置, 定期将杂物清理出分离器, 保证制粉系统的安全运行。性能试验表明: 轴向分离器改造后的节能效果明显, 切实降低了磨煤单耗, 且停运磨煤机清理杂物的周期大大延长。

## 1 轴向分离器特点

(1) 实现双级轴向分离。除将原径向型分离器改为轴向型外, 在分离器内锥下部、内外锥之间的空间增加一级可调轴向挡板, 使煤粉气流从分离器下部开始旋转分离, 延长了旋转路程, 增强了分离效果, 从而提高出口煤粉细度和均匀性; 同时, 挡板角度可灵活调节, 相邻级挡板反向安装, 有利于强化煤粉颗粒碰撞沉降的效果。

(2) 降低系统阻力。轴向型挡板与径向型挡板结构完全不同, 杂物由于重力作用无法在挡板处停留, 堵塞的可能性减小; 轴向型挡板的最小通流面积增加, 旋流空间增大, 有助于减小分离器系统阻力, 增加出粉率, 降低磨煤单耗。

(3) 具有较好的细度调节特性。双级轴向型挡板调节范围大, 磨煤机分离器挡板开大时煤粉细度增大, 反之则减小。可根据煤质的不同, 灵活调节两级挡板, 在保证制粉系统出力的前提下, 将煤粉细度控制在 5% ~ 10%<sup>[5]</sup>。

(4) 无积粉死角。将原分离器内锥体改为全封闭内筒, 不再出现短路及堵塞现象, 基本可以杜绝内锥堵粉<sup>[6]</sup>。

## 2 改造方案

在已有分离器的空间范围内, 通过设计和优化, 将 #1 锅炉 A 磨煤机两侧的径向分离器改造为双级轴向型, 改造方案如图 1 所示。

具体改造方案如下。

(1) 拆除原径向分离器的旋流分离室、径向挡板、内锥帽等部件, 保留原分离器的入口和回粉管, 保持安装支架、内外锥主体等分离器的基础不动。

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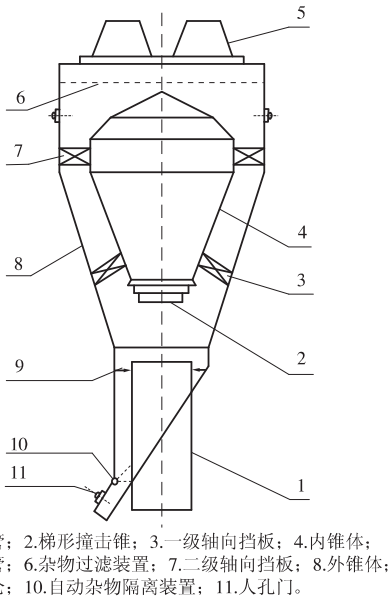


图 1 改造方案示意

(2) 分离器出口和一次风管道整体升高 1.5 m , 将重新设计的旋流分离室、轴向挡板、杂物过滤装置和内锥帽与原分离器内外锥体对接。

(3) 在分离器内锥下部、内外锥之间的空间增加一级可调轴向挡板 , 并在内锥体底部加装梯形撞击锥 , 借助气流的扩容作用促进煤粉的重力分离。

(4) 在出粉口适当位置加装杂物过滤格栅 , 将杂物拦截在分离器内。配套安装压缩空气反向吹扫装置 , 定期停运 , 利用压缩空气将格栅上的大部分杂物吹落 , 减少人工清理过滤格栅的次数。

(5) 在锁气器上部回粉斜管位置加装自动杂物隔离装置。借助滤网自动翻转和压缩空气吹扫清理装置 , 实现过滤装置的定期翻转、清理。杂物隔离装置的外形如图 2 所示。

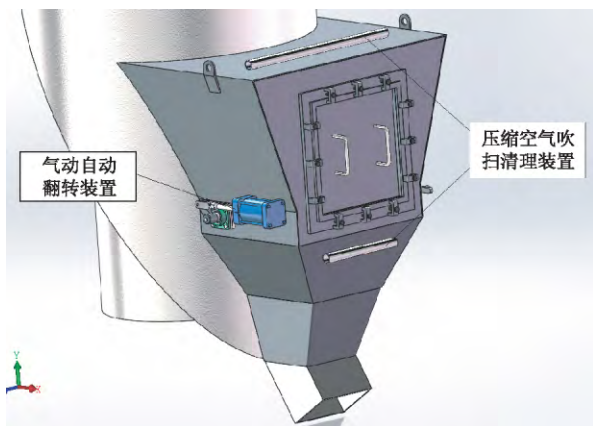


图 2 杂物隔离装置外形

### 3 效果验证

#### 3.1 挡板调节特性分析

对改造后分离器的挡板调节特性进行试验 , 验

证轴向挡板的细度调节特性。在 #1 锅炉 A 磨煤机 A2 侧稳定正常出力的工况下 , 保持下级分离器挡板开度稳定在 30° , 调整上级轴向挡板到 4 个不同开度 , 得出煤粉细度随分离器上级挡板开度变化的关系曲线 , 如图 3 所示。由图 3 可见 , 随着 A2 侧上级分离器挡板开度由 15° 开大至 60° , 煤粉细度  $R_{90}$  由 6.47% 增大至 11.70% , 且改造后轴向分离器的线性调节性能较好。

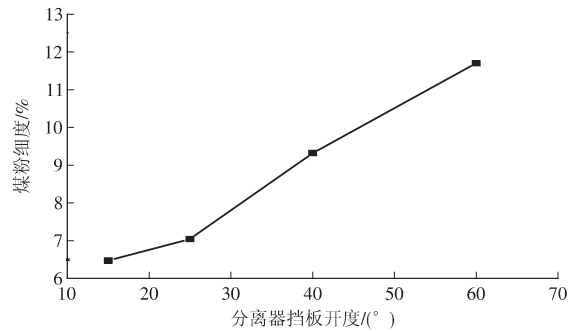


图 3 煤粉细度随分离器上级挡板开度的变化

#### 3.2 改造前、后分离器性能对比

将 A 磨煤机的通风量控制在 70 t/h , 比较改造前磨煤机出力 35 t/h ( 工况 A ) 、改造后磨煤机出力 35 t/h ( 工况 B ) 和出力 48 t/h ( 工况 C ) 的条件下 , 磨煤机电流、磨煤单耗、煤粉细度  $R_{90}$  及均匀性指数的变化 , 如图 4 所示。

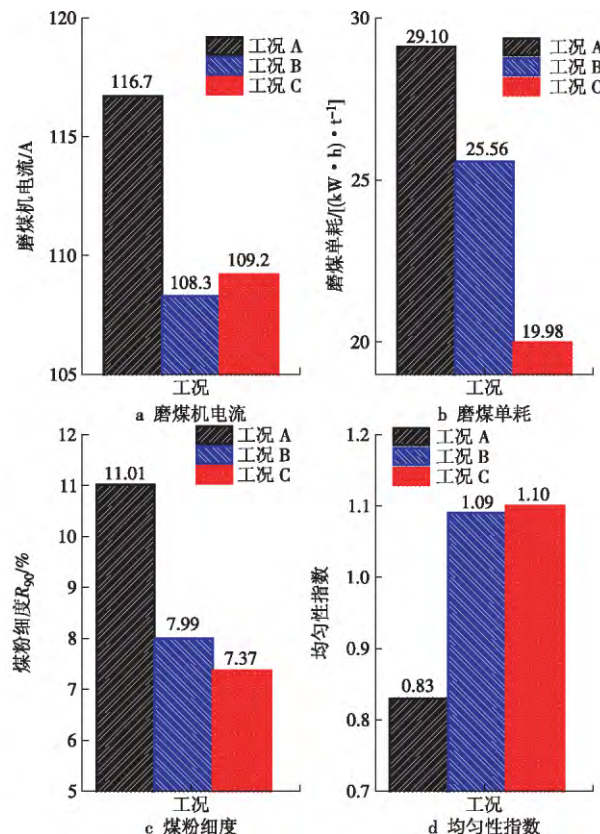


图 4 改造前、后分离器性能对比

对比工况 A 和工况 B , 在 A 磨( 下转第 43 页)

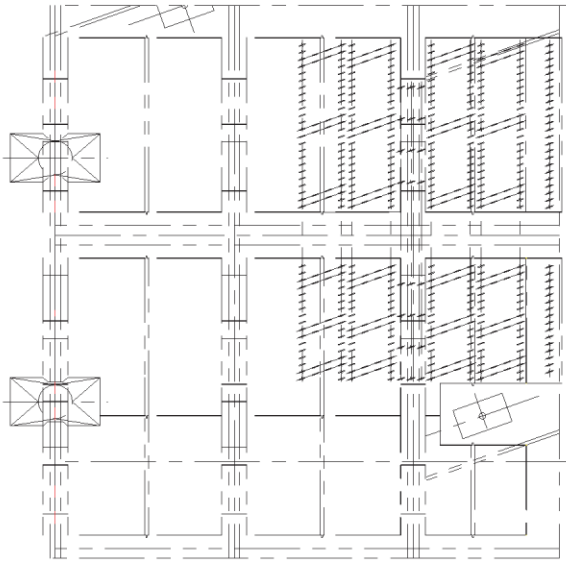


图 4 锅炉两侧墙增加分割风示意(局部)

#### 4 结束语

2015 年 7—10 月,研究制定了切实可行的改进措施,首次提出了在炉膛内部送入防焦风和分割风的新思路,即在锅炉水冷壁鳍片上切割出分割缝,送入热二次风,以减少涡流区域中灰粒子与水冷壁接触的机会,同时分割水冷壁壁面上的焦块,防止大焦块的生成。该成果的实施,解决了锅炉两侧墙水冷

(上接第 24 页)煤机出力为 35 t/h 的条件下,轴向分离器改造后,磨煤机电流从 116.7 A 降至 108.3 A,磨煤单耗从 29.10 (kW·h)/t 降至 25.56 (kW·h)/t,磨煤单耗下降幅度达 12.2%,改造节能效果显著;同时,分离器出口煤粉细度  $R_{90}$  从 11.01% 降至 7.99%,均匀性指数从 0.83 升至 1.09,说明改造后分离器的分离效果较好,出粉变细,更有利于煤粉在炉膛内的着火和燃尽。

保持通风量不变,维持分离器上挡板 40°开度、下挡板 30°开度,将磨煤机出力增加至 48 t/h。对比工况 A 和工况 C 可看出,通过轴向分离器改造,在制粉系统出力提高 36% 的情况下,磨煤机电流从 116.7 A 降至 109.2 A,分离器出口煤粉细度  $R_{90}$  从 11.01% 降至 7.37%,且磨煤单耗和均匀性指数均有所改善。说明改造后制粉系统各项性能有较大提升,在保证正常出力的情况下,磨煤机出力可提高 36% 以上。

#### 4 结束语

将双进双出磨煤机的径向分离器改造为双级轴向型,并在出粉口和回粉斜管上加装杂物过滤装置,在保证合格煤粉细度的前提下,既增加了磨煤机出

壁区域、炉膛前后墙与侧墙夹角处、B/C 层燃烧器区域大焦块集中掉落的问题,减少了锅炉炉膛内部大焦块集中掉落而引起的炉膛负压大幅度波动、火检闪烁,甚至锅炉灭火的隐患,锅炉运行的安全性、稳定性大幅度提高。

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力,又缓解了杂物堵塞的问题,具有较好的节能效果和安全保证。

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2.64 g/(kW·h), which has a good economic benefits and environment protection benefits.

**Keywords:** coal-fired power plant; condenser; tube bundle arrangement; bionic tube bundle arrangement pattern

### 2017-06-20 Integrated feeder automation based on partitioned and layered mode case study

**WANG Wei<sup>1</sup>, LI Meng<sup>2</sup>** (1. Guodian Nanjing Automation Company Limited, Nanjing 210000, China; 2. Shaanxi Local Power Company Limited Baoji Power Supply Branch, Baoji 721000, China)

**Abstract:** To handle the power distribution network fault, trina-tional feeder automation system program flow was analyzed. The drawback of this process while handling complicated fault was indicated. Applying partitioned and layered monitoring distribution to teat failure will flexible handle fault and enhance system facing extreme case such as composite fault.

**Keywords:** feeder automation; composite fault; fault positioning; fault isolating; fault recovery

### 2017-06-23 Separator transformation and optimization of double-inlet and double-outlet coal mill for a 300 MW unit

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**Abstract:** For the 300 MW boiler in Shijiazhuang Liangcun Thermal Power Company Limited, a MGS4062 type double-inlet and double-outlet coal mill is adopted. As the declining of coal quality and the increasing of coal impurities, there is a serious blocking problem for the matched radial baffle type separator, which influences the unit load capacity. Through transforming the separator into a two-stage axial type and adding impurity filters at powder outlet and inclined powder returning pipe, the pulverized coal uniformity index is greater than or equal to 1, coal mill unit consumption decreases by 12.2% and coal mill capacity increases by 36% under normal capacity condition. Meanwhile, the impurities of coal are filtered and cleaned out to avoid blocking the primary air pipe and clapper.

**Keywords:** double-inlet and double-outlet coal mill; blocking; two-stage axial separation; impurity filter; coal mill unit consumption

### 2017-06-25 Coal storage and using strategy based on inventory theory and linear programming

**CHEN Peng<sup>1</sup>, YANG Jingpei<sup>1</sup>, GAO Jianqiang<sup>2</sup>** (1. Anhui Energy Group Company Huaibei Guoan Electric Power Company Limited, Huaibei 235000, China; 2. North China Electric Power University Graduate School, Baoding 071000, China)

**Abstract:** The limited supply and short-supply not allowed coal storage model was built based on inventory theory. This optimized the coal ordering strategy. After analyzing coal mixture ratio by built objective linear equation and constraint equation,

coal consuming strategy was optimized. This ensured lowest unit coal cost. Take Anhui Energy Corporation Company Huaibei Guoan Electricity Company Limited the first quarter coal purchasing as study objective, by comprehensive analyzing coal storage and utilization, economic storage and using was realized.

**Keywords:** coal storage; coal consumption; inventory theory; linear programming; model; economy

### 2017-06-28 S109FA gas-steam combined cycle unit D10 steam turbine performance diagnosis analysis

**CAI Yu<sup>1</sup>, ZHAO Lijuan<sup>2</sup>, DING Yongneng<sup>2</sup>, LI Wei<sup>1</sup>** (1. College of Energy Engineering, Zhejiang University, Hangzhou 310027, China; 2. Hangzhou Huadian Banshan Generation Company Limited, Hangzhou 310015, China)

**Abstract:** Based on the structure feature of a power plant's S109FA gas-steam combined cycle unit D10 steam turbine, the performance data of different test period was compared. It was indicated that the unit performance lost in the past 10 years. Combined with the problems found during maintenance, the causes of performance loss were indicated as high pressure cylinder vane damage and flow part scaling. Prevention measurements and suggestion was indicated. This performance analysis could be referred for performance improvement projects of similar units.

**Keywords:** gas-steam combined cycle unit; D10 steam turbine; flow part structure; performance diagnosis

### 2017-06-32 Service power system reconstruction plan and application practice after thermal power plant unit close down

**ZHAO Qingming, XIAO Mingwei** (Huadian Zibo Heat and Power Company Limited, Zibo 255054, China)

**Abstract:** With the development of energy saving and emission control, it is inevitable that small coal-fired units be close down. After Huadian Zibo Heat and Power Company Limited third stage extension project (2×330 MW) unit put into operation, the first stage was closed down. Due to the relevance of first and second stage water, steam, coal and electricity system, this paper introduced a service power system reconstruction plan based on safety economy and smooth transition. Combined with specific implementation process, relevant project management method and experience was summarized.

**Keywords:** unit close down; service power system; system reconstruction; smooth transition

### 2017-06-37 Study on the transformation and optimization of 660 MW ultra supercritical boiler burner

**CAI Hongming** (Guangzhou Red Bay Generation Company Limited, Shanwei 516600, China)

**Abstract:** With regards to the severe damage of a 660 MW ultra supercritical boiler burner operation after a period of time, based on the analysis of improved method of burner to reduce corrosion and reducing atmosphere of side wall, and through the study on optimization of transformation, effectively reduce the NO<sub>x</sub> emissions and ensure complete combustion, which has instructive si-