

辊压机钢渣微粉加工应用技术

TECHNOLOGY AND APPLICATION OF ROLLER PRESS USED FOR PROCESSING FINE STEEL SLAG POWDER



主要技术优势

Main technical advantages

- 系统设备数量少，设备维护量小；
- 系统电耗低；
- 与早期带旋风筒的联合粉磨系统相比，避免了设备的磨损。
- Less equipment and maintenance work
- Low power consumption
- Comparing with earlier combined grinding system with cyclone, it avoids wear to equipment

1 钢渣粉磨处理的意义

SIGNAFICANCE OF SUPER GRINDING OF STEEL SLAG

如果将钢渣粉磨到比表面积450m²/kg左右，作为水泥的混合材或混凝土的活性掺合料，一方面，由于钢渣粉的颗粒粒度很小，使得游离氧化钙和游离氧化镁在构件硬化之前与水反应完毕，彻底消除了钢渣的体积稳定性问题。另一方面，目前每吨钢渣粉的市场价在100元左右。加上生产过程中磁选出来的铁精粉和颗粒钢，则每处理一吨钢渣的净利润可达100元左右（来源于《济南钢铁厂钢渣微粉生产实践》）。同时，由于减少了水泥熟料的用量，从而间接地减少了生产水泥的能耗和CO₂的排放。

使用辊压机部分或全部取代球磨机进行钢渣粉磨，是一种生产能力大，系统能耗低的钢渣粉制备系统。下图是用辊压机代替球磨机生产钢渣微粉的系统电耗变化关系（产品比表面积450m²/kg）：

If to grind steel slag to reach specific surface area at 450m²/kg, it could be used as additive of cement or active filler of concrete. On the one hand, because steel slag has very small particle, which enables free CaO and free MgO fully completes its reaction with water before it becomes hard, and fully eliminates the problems of stability of steel slag volume. On the other side, presently the market price of steel slag is RMB 100 per ton. Considering fine iron power and steel particles selected by metal separator, the net profit can reach RMB 100 per ton steel slag. In the meanwhile, owing to reducing consumption of clinker, it indirectly reduces energy consumption and CO₂ emission of cement production. To use roller press partially or fully in place of ball mill for steel slag grinding is a type of large capacity low energy consumption steel slag grinding system. The following figure is the Power Consumption Variation Relation of Ball Mill and Roller Press(specific surface area at450m²/kg):

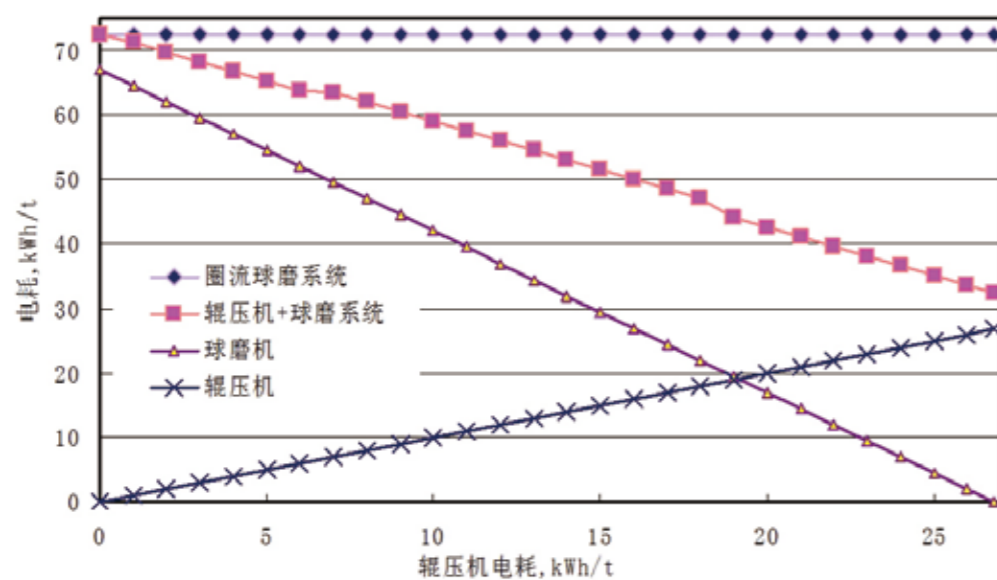


图1 辊压机代替球磨机后的系统电耗变化关系
Figure 1 Power Consumption Variation Relation of Ball Mill and Roller Press

2 钢渣粉制备工艺比较

COMPARIOSN OF STEEL SLAG GRINDING SYSTEM

辊压机与球磨机组成的联合粉磨系统与其它系统的比较见下表：

The following table shows the difference between combined grinding system (BALL MILL+ROLLER PRESS) and other types of grinding system.

系统方案	球磨机 圈流系统	辊压机+球磨机 联合粉磨系统	辊压机 终粉磨系统	辊式磨 终粉磨系统
系统电耗,kWh/t	90	55~60	45	45
烘干能力	差 (单独烘干)	好 (V选烘干)	好 (V选烘干)	很好 (磨内烘干)
影响运转率主要原因	运行一定周期要倒球 清除铁渣	辊面磨损后的堆焊	辊面磨损后的堆焊	压辊及盘衬堆焊
规模化	困难	容易	容易	容易

	Ball Mill Close Circuit	Ball Mill+Roller Press Combined Grinding System	Roller Press Finish Grinding system	VRM Finish Grinding system
System Power Consumption,kWh/t	90	55~60	45	45
Drying Capacity	Bad (separate drying)	Good (drying at V separator)	Good (drying at V separator)	Very Good (drying at mill internal)
Main Factors impacting Availability	Clearing grinding media and iron residue after running a certain period	Welding Hardfacing after wear	Welding Hardfacing after wear	Welding Hardfacing after wear
In Scale	difficult	easy	easy	easy

尽管辊磨和辊压机都属于料床挤压类粉碎设备，但它们又有明显的差别，前者属于非完全限制性料床挤压，而后者属于完全限制性（或称近似于完全限制性）料床的挤压。正由于这一本质上的区别，决定了它们的工作压力不能相同，因为对非完全限制的料床实施挤压时，当施压压力高于某一定值时（料床中物料的种类及组成不同，最高的限制压力也有所不同），料床失稳，挤压功效不再增加，能量利用率下降（如图所示）。

Vertical roller mill and roller press all belong to material bed press equipment, but they are of apparent difference. Vertical roller mill belongs to incomplete restricted material bed press, however roller press belongs to complete restricted material bed press (or approximately complete restricted material bed press). Due to such difference, it decides they are of different working pressure. The reason is for incomplete restricted material bed press, when pressure exceeds a certain fixed value (the maximum restricted pressure differs due to different types of material in material bed), the material bed loses its stability, and also press force will be no more increased and energy utilization reduced. (See Figure 2).

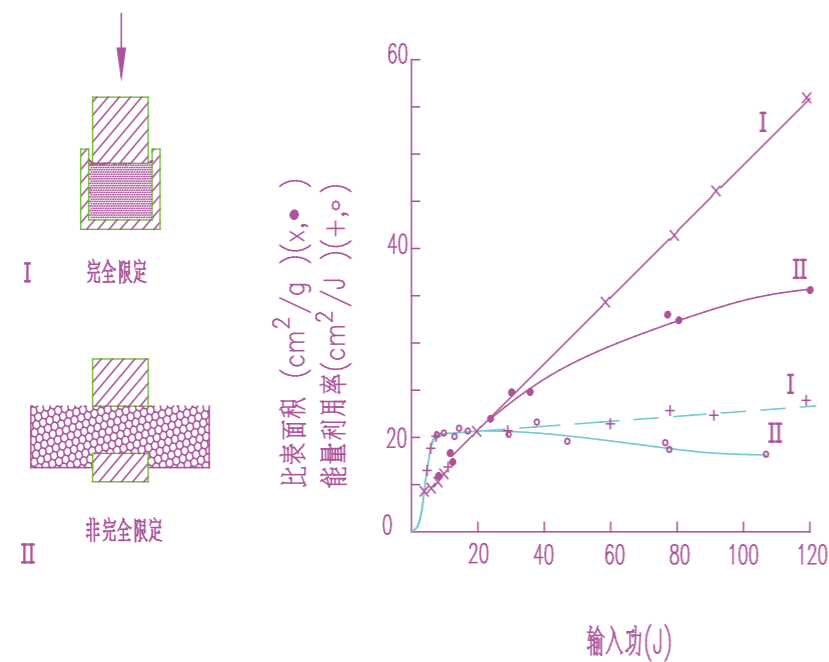


图2 辊磨和辊压机能量利用率的关系
Figure 2 Energy Utilization of VRM & Roller Press

另外，在粉磨过程中，辊压机的工作面属于“线线接触”，且两个压辊等速相向旋转，不存在相对位移；而辊式磨的工作面属于“线面接触”，且由于回转半径的不同存在相对位移。因此，对于粉磨硬度较高的钢渣而言，在设备的磨损方面，辊压机要优于辊式磨。

Besides, during grinding process, the working face of roller press is “line-line contact”, and 2 rollers rotates reversely in same speed with no relative displacement. But the working face of VRM is “line-face contact”, it is of relative displacement owing to different rotation radius. By such reason, regarding to high hardness steel slag, the roller press is of less wear comparing with VRM.

3 钢渣粉磨系统工艺流程

PROCESS OF STEEL SLAG GRINDING SYSTEM

新喂物料与出辊压机物料一起由提升机送入V型选粉机内风选，风选后，较细物料由风带入双分离高效选粉机与出球磨机的物料再次被风选，粗物料落入辊压机上面的核重小仓内，继而被辊压机辊压粉磨；经双分离高效选粉机风选后，合格的成品由风带入后面的袋式收尘器进行收集后入成品库，未达到成品要求的物料可根据实际生产情况决定其部分或全部返回辊压机或者进入球磨机被再次粉磨，出球磨机的物料由提升机及空气斜槽从顶部喂入双离高效选粉机。球磨机内的通风由单独的风机负责。

Feed material and material after roller press will be fed to V-separator by bucket elevator. After separation, finer material will be brought to high efficiency separator and classified with the material from ball mill. Coarse material falls down to weigh bin above roller press and is reground by roller press. After separation by high efficiency separator, qualified product will be collected by bag filter and transported to silo. Disqualified product can, according to production requirement, partially or completely back to roller press or come into ball mill for re-grinding. Material at ball mill outlet will be conveyed by bucket elevator and air slide to the top of high efficiency separator. Ball mill ventilation is responsible by separate fan.

该系统的优点有：

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- 系统电耗低；
- 与早期带旋风筒的联合粉磨系统相比，避免了设备的磨损。

The advantage of this system is:

- Less equipment and maintenance work
- Low power consumption
- Comparing with earlier combined grinding system with cyclone, it avoids wear to equipment

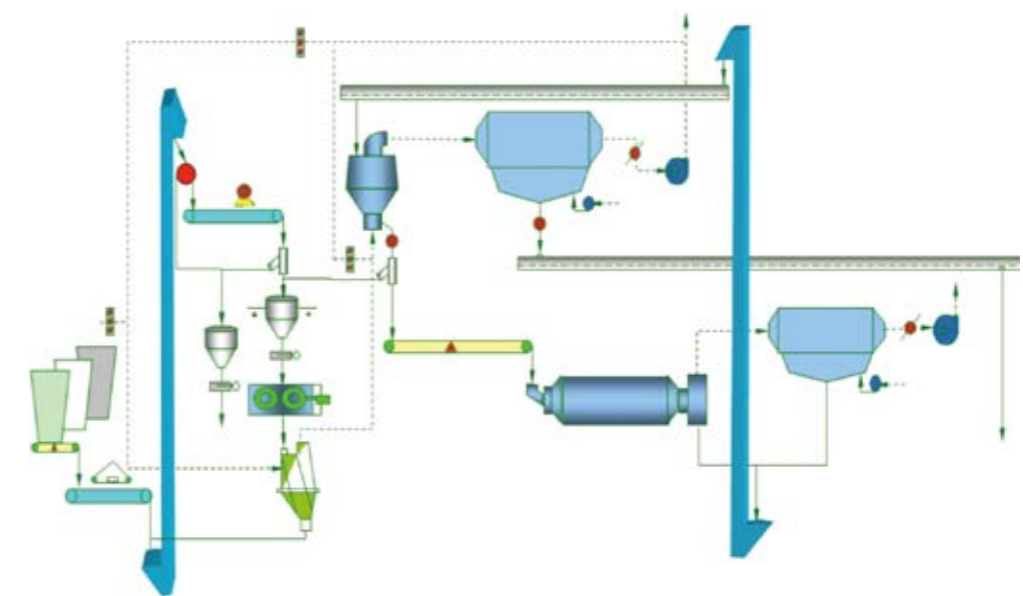


图3 辊压机+球磨机钢渣联合粉磨系统
Figure3 Ball Mill+ Roller Press Steel Slag Grinding System

4 辊压机+球磨机联合粉磨系统配置

CONFIGURATION OF BALL MILL+ ROLLER PRESS COMBINED GRINDING SYSTEM

	年产60万吨钢渣粉磨系统	年产30万吨钢渣粉磨系统
产量	80~90t/h	40~45t/h
比表面积	4500 ± 200cm ² /g	
电耗	主机电耗（辊压机+球磨机）45kWh/t，系统电耗60kWh/t	
辊压机	规格TRP160/120 电机功率2000kW	规格TRP140/80 电机功率1000kW
球磨机	规格φ4.2×13.0m电机功率3150kW	规格φ3.2×13.0m 电机功率1600kW
选粉机	风量210000m ³ /h	风量120000m ³ /h
袋收尘器	处理风量210000m ³ /h	处理风量120000m ³ /h
系统风机	风量230000m ³ /h 全压7500Pa 功率710kW	风量135000m ³ /h 全压7500Pa 功率400kW

	Steel Slag Grinding System (600000t/y)	Steel Slag Grinding System (300000t/y)
Capacity	80~90t/h	40~45t/h
Specific Surface Area	4500±200cm ² /g	
Power Consumption	Power Consumption of Equipment(roller press + ball mill)45kWh/t, power consumption of system 60kWh/t	
Roller Press	Type TRP160/120 Power 2000kW	Type TRP140/80 Power 1000kW
Ball Mill	Type φ4.2×13.0m Power 3150kW	Type φ3.2×13.0m Power 1600kW
Separator	Volume210000m ³ /h	Volume120000m ³ /h
Bag Filter	Volume210000m ³ /h	Volume120000m ³ /h
System Fan	Volume230000m ³ /h Full Pressure 7500Pa Power710kW	Volume135000m ³ /h Full Pressure 7500Pa Power400kW





AND APPLICATION
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