



# 北京金煤创业科技股份有限公司

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## DJM 陶瓷金属复合立磨备件（辊套与磨盘）技术介绍

DJM Meatl ceramic composite vertical mill spare parts (roller and pan) technology introduction

由于立磨的低能耗，新建的大型水泥生产线基本均采用立磨作为生料磨/煤磨，甚至水泥磨，最大的立磨产量可达 600-700 吨/小时，而对立磨中备件即辊套与磨盘要求具有防断裂的可靠性及抗磨损的耐磨性。通常辊套与磨盘所采用的合金有 4 类，即：Mn 钢、NihardIV 合金、高 Cr 合金、Hardfacing（表面堆焊）。虽然从 Mn 钢至表面堆焊，其材料硬度越来越大，耐磨性提高，但同时其脆性也大大增加，断裂的危险性也越来越大。因而如何选择具有高耐磨性但又该防止断裂的材料成为决定立磨备件材料的重要决定因素。

一般 LM, ZGM, HP 和 CKP 立磨的辊子为一个整体，一般原设备制造商均采用高 Cr 合金铸造，其断裂的危险较大，耐磨寿命自然较低。针对这一情况，DJM 选用铁基陶瓷复合材料，即辊子的基体采用塑性铸铁或高铬铸铁，其有一定的弹性伸长，因而具有抗断裂的完全安全性，同时在基体上嵌铸具有高耐磨性的陶瓷加强筋，因而大大提高辊子的耐磨性。由于其完全抗断裂的性能，这种辊子的磨损后重量甚至可以为初始重量的 30% - 40%，而 Mn 钢或 NihardIV 合金一般为 50 - 60%，而这种加强筋的设计使得即使在加强筋上出现裂纹，也不会扩展至基体，因而完全不影响耐磨使用寿命。另外，这种设计也使得磨损更为均匀，在整个寿命期内产量更为稳定，避免了高铬辊子通常出现的大波纹磨损及大直径端的尖角形成。陶瓷复合材料辊子的寿命与一般高铬辊相比，寿命可达 1.5 - 2 倍以上。

针对 MPS、ATOX 和 RM 立磨的陶瓷复合材料技术及高 Cr 材料，一般 MPS 立磨、ATOX 和 RM 立磨的辊套由数块组成。这类辊套的断裂危险性不大，最主要的因素为其耐磨性即耐磨寿命，一般原设备制造商均采用 NihardIV 合金或高 Cr 合金。为进一步提高其耐磨寿命，DJM 选用高 Cr 陶瓷复合材料，即在高 Cr 材料表面注入陶瓷颗粒形成陶瓷金属复合材料层，这层复合层的耐磨性能可达高 Cr 材料的 3 - 4 倍，同时这一复合层的厚度可制成达到原备件厚度的 1/3，并可根据原磨损曲线有针对性的制作，即使某些颗粒出现裂纹，也只局限于颗粒本身而不扩展至基体。金属陶瓷辊套和衬板磨煤时平均磨损量（磨损深度）每 1000 小时为 2-4mm，而高铬辊套和衬板磨煤时平均磨损量（磨损深度）每 1000 小时为 5-9mm，金属陶瓷辊套使用到 15000 小时左右，其最大磨损量（磨损深度）在 43mm~46mm，磨辊中线处磨深只有 15mm 左右，金属陶瓷辊套单面使用寿命是高铬产品的 2 倍以上，金属陶瓷衬板是高铬产品的三倍以上。

Due to vertical mill low energy consumption, the newly built large-scale cement production line adopts vertical mill as basic raw material/coal grinding, even cement mill, the largest vertical mill output can reach 600-600 tons/hour, while the roller is required with reliable against fracture and abrasive wheel wear resistance. Usually adopt four types alloy: Mn steel, NihardIV alloy, high Cr alloy, Hardfacing (surface overlaying). Although Mn steel to surface overlaying, the material hardness is more and more big, the wear resistance improved, but its brittleness has been greatly increased at the same time, the risk of fracture is also growing. So how to choose the material with high resistance to wear and can prevent fracture become the important determinants of vertical mill spare parts materials.

Generally, LM and CKP vertical roller as a whole setting, so if using high Cr alloy, the fracture risk is bigger, so the general original equipment manufacturers are using good plasticity Mn steel roller, but its abrasion resistant life maturely is low. Aimed at this situation, DJM choose iron base

ceramic composite materials, which is the roller basement with plasticity iron, it has 4% elongation, thus has completely safety of resistance to fracture and embed high wear resistance of ceramic reinforcement into the iron basement, to get great improvement wear resistance. Due to its complete rupture of resistance, weight can even get 30%-40% of original roller after wear, the weight of the Mn steel or alloy NihardIV generally 50-60%, and the reinforcement design makes even in the process causes cracks to appear on the stiffener, won't be extended to the basement, thus completely does not affect the service life of the wear resistant. In addition, this design also makes the wear is more uniform, more stable production in the whole life period, to avoid the typical Mn steel roller wear big ripple and the Angle formed on large diameter end. The life of the ceramic composite roller, compared with common Mn steel roller life can reach more than 1.5-2 times.

On MPS, ATOX and RM vertical mill ceramic composite technology and high Cr materials, general MPS, ATOX and RM vertical mill roller consists of several blocks. This kind of roller fracture risk is not big, the main factors for its abrasion wear life, generally, original equipment manufacturers adopt NihardIV alloy or high Cr alloy. To further increase its wear life, DJM selects high Cr ceramic composite materials, which forms the ceramic metal composite reinforcement through injection of ceramic particles into the high-Cr material, the composite layer wear-resisting property is than high Cr material 3-4 times, at the same time, the composite layer thickness can be made to a third of the thickness of the original spare parts, and can make the targeted composite material according to original wear curve. Even if some particles crack, also are limited its own, can't expand the basement. Ceramic composites roller life is more than 2 times than NihardIV alloy and high Cr alloy.

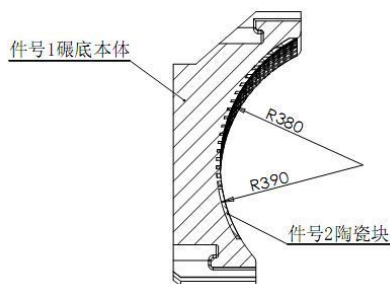
Product include:

High Cr cast iron + ZTA ceramic particles

Martensite steel + ZTA ceramic particles

附图-3-铁基陶瓷复合材料磨盘示意图

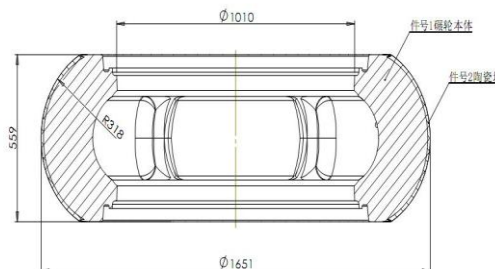
Picture -3 sketch map of Mill pan



Position-1 basis material Position-2 Ceramic composites

附图-3-3-铁基陶瓷复合材料辊套示意图

Picture -3-3 sketch map of roller





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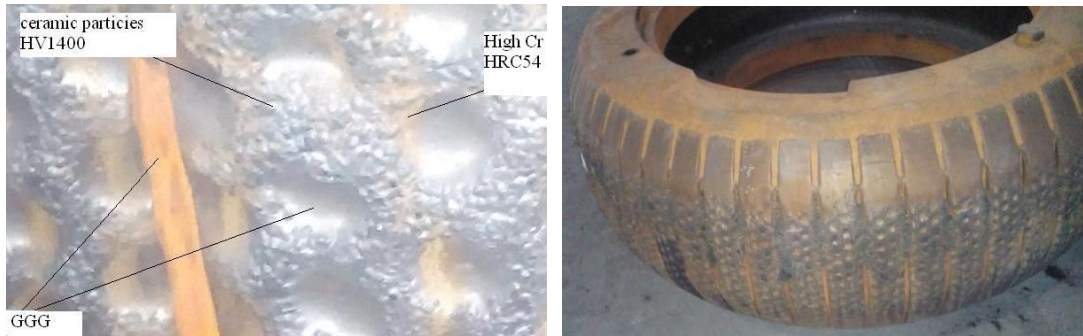
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附图-3-1 铁基陶瓷高铬复合 ZGM 辊套外观图

Picture 3-1 Metal Ceramic Composite Roller (ZGM Roller in GGG + High Cr + ZAT ceramic)



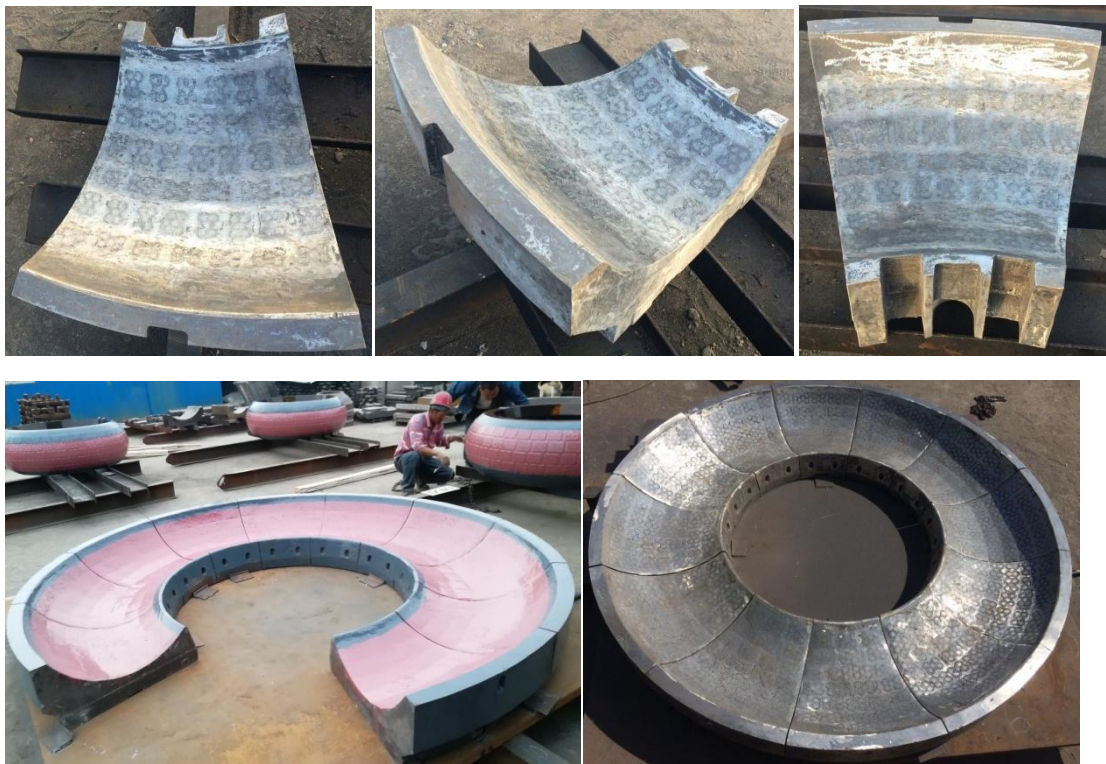
附图-3-2 高铬陶瓷复合 ZGM 辊套外观图

Picture 3-2 Metal Ceramic Composite Roller (ZGM Roller of High Cr cast iron +ZTA ceramic)



附图-3-3 高铬陶瓷复合 ZGM 衬板外观图

Picture 3-3 Metal Ceramic Composite Liner (ZGM Liner of High Cr cast iron +ZTA ceramic)







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附图-3-4 高铬陶瓷复合 HP 衬板外观图

Picture 3-4 Metal Ceramic Composite Liner (HP863 Liner of High Cr cast iron +ZTA ceramic)

