北京金煤创业科技股份有限公司
BeiJing JinMei Entrepreneur Co., Ltd.

金属基陶瓷复合材料简介

MMC - Metal matrix ceramic composite material

公司简介
Company profile

北京金煤创业科技股份有限公司于2006年成立，2016 年改制为股份制公司并成功登陆新三板。公司总部坐落在中国北京中关村科技园古城基地。是集研发，生产，出口销售的互联网+新材料制造企业。
公司主营金属基陶瓷复合材料，耐磨耐热材料，冶金、矿山、水泥、燃煤热电厂设备配件等。产品：高铬陶瓷复合铸造耐磨材料，马氏体钢陶瓷复合铸造耐磨耐冲击材料及各类高锰钢陶瓷复合材料，金属基陶瓷纤维复合材料。

Beijing JinMei Entrepreneur Co., Ltd (DJM) was established in 2006, Headquarter located in Zhongguancun High-tech Park in Beijing, China. DJM was restructured into Joint-Stock company & listed on NEEQ in 2016. DJM's a research and development, production, export sales of Internet + new materials manufacturing enterprises.
DJM is focusing on Metal Matrix Ceramic Composite (MMCC) material, wear-resistant and heat-resistant material.

Products: High chromium cast iron ceramic composite castings, Martensite steel ceramic composite castings, high manganese steel ceramic composite castings, and Metal matrix ceramic fibre composite casting materials, ZTA ceramic mechanical parts. Products are widely used in metallurgical industry, mining, cement, Coal-fired thermal power plant as spare parts.

MMC- 金属基陶瓷颗粒复合铸造生产技术

Metal matrix ceramic particle insert casting Technology

- 金属基陶瓷复合铸造工艺是将合金化后的陶瓷颗粒与基体金属通过冶金铸造工艺融合形成陶瓷颗粒与金属的复合层，实现金属基体与增强相的浸润和复合，陶瓷颗粒与金属的冶金结合是通过金属液体的热量传导来实现的，增强相的组织结构特征使其具有很高的强度和耐磨性能，可有效控制增强相厚度并实现大面积复合，使增强相与金属基体融合在一起没有明显界限，提高其耐磨寿命；复合材料层的耐热耐磨性能是高铬材料的3-4倍，同时复合材料层厚度可达原零件厚度的1 / 3以上，陶瓷复合层大大提高了产品的使用寿命，使用寿命是传统材料的几倍。

- 陶瓷本身具有耐高温（烧结温度1700度）、高硬度（HV2100）、高耐磨、抗氧化的性能，陶瓷颗粒弥散分布于金属基体中极好解决了两相热膨胀不一致的问题，合金化后的陶瓷颗粒与基体金属实现冶金结合解决陶瓷颗粒脱落的问题，陶瓷颗粒与基体金属组成的复合层可以充分发挥陶瓷的耐热抗氧化耐磨性能且具有基体金属的机械性能，从而满足恶劣工况条件下的耐热抗氧化耐磨要求

- 陶瓷复合层的蜂窝结构保持基体金属的原有机械性能特性，并可以充分发挥基体金属的机械性能特性，基体金属与陶瓷颗粒形成优势互补的复合层。在使用初期，陶瓷复合层中的基体金属会首先磨损并形成凹陷，弥散分布于金属基体中陶瓷颗粒会逐渐凸出于基体金属，凸起后的陶瓷颗粒开始对基体金属形成保护作用，利用自身的耐热耐磨性能阻断磨削力及热辐射传递，改变磨削力及热辐射传递方向，形成阴影效应减少基体金属磨损。

- 耐热钢在高温环境下会在金属表面形成氧化层，氧化层的厚度，氧化层剥落面积，剥落时间决定了它的使用寿命，氧化层每剥落一层金属即耗损一层直至完全失效，弥散分布于基体金属的陶瓷颗粒能适当强化晶粒，减少晶界数量，且将基体金属表面形成的氧化层分割成更小的氧化层区域，更小的氧化层区域更容易形成比较薄的氧化层，更小的氧化层区域每次剥落的氧化层更小，从而减缓基体金属氧化层的剥落时间，减少剥落面积及剥落厚度，提高有效使用寿命

- Metal-based ceramic composite casting process is to melt alloyed ceramic particles and matrix metal through metallurgical casting process to form a composite layer of ceramic particles and metal, so as to realize the infiltration and composite of metal matrix and reinforcement phase. The metallurgical combination of ceramic particles and metal is realized through the heat conduction of metal liquid. The microstructure characteristics of the reinforced phase make it have high strength and wear resistance, which can effectively control the thickness of the reinforced phase and realize large-area composite, so that the reinforced phase and the metal matrix are fused together without obvious boundaries, and the wear resistance life is improved. The heat and wear resistance of the composite layer is 3-4 times that of the high chromium material, and the thickness of the composite layer can reach more than 1/3 of the thickness of the original part. The ceramic composite layer greatly improves the service life of the product, and the service life is several times that of the traditional material.

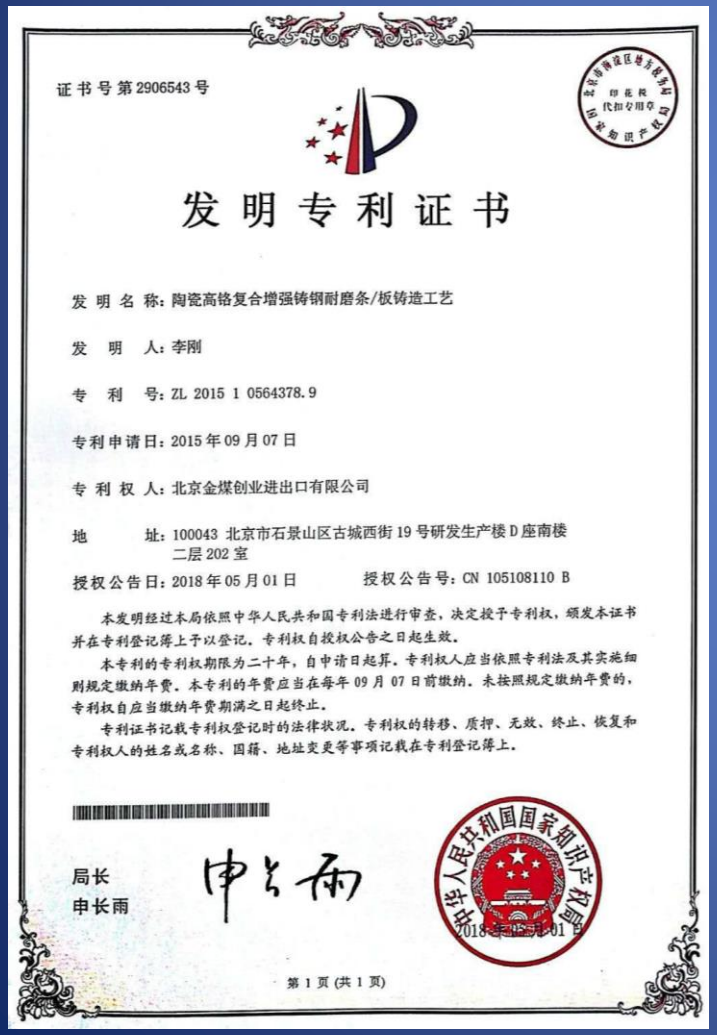
- Ceramic itself has high temperature resistance (sintering temperature 1700 degrees), high hardness (HV2100), high wear resistance, anti-oxidation properties, ceramic particles dispersed in the metal matrix to solve the problem of inconsistent two-phase thermal expansion, alloyed ceramic particles and matrix metal to achieve metallurgical combination to solve the problem of ceramic particles falling off. The composite layer composed of ceramic particles and matrix metal can give full play to the heat resistance, oxidation resistance and wear resistance of ceramic and the mechanical properties of matrix metal, so as to meet the requirements of heat resistance, oxidation resistance and wear resistance under harsh working conditions

- The honeycomb structure of the ceramic composite layer maintains the original mechanical properties of the matrix metal, and can give full play to the mechanical properties of the matrix metal, and the matrix metal and ceramic particles form a complementary composite layer. In the initial stage of use, the matrix metal in the ceramic composite layer will first wear and form a depression, and the ceramic particles dispersed in the matrix metal will gradually protruding from the matrix metal. The raised ceramic particles will begin to form a protective effect on the matrix metal, and use its own heat and wear resistance to block the grinding force and heat radiation transfer, changing the direction of the grinding force and heat radiation transfer. Formation of shadow effect to reduce matrix metal wear.

- The heat-resistant steel will form an oxide layer on the metal surface in a high temperature environment, the thickness of the oxide layer, the area of the oxide layer, the peeling time determines its service life, each layer of the oxide layer of metal is lost until the complete failure, the ceramic particles dispersed in the matrix metal can properly strengthen the grain, reduce the number of grain boundaries, And the oxide layer formed on the surface of the base metal is divided into smaller oxide layer regions, smaller oxide layer regions are easier to form a relatively thin oxide layer, and smaller oxide layer regions each time the peeling layer is smaller, thereby slowing down the peeling time of the base metal oxide layer, reducing the peeling area and peeling thickness, and improving the effective service life

发明专利证书
Patent certificate

陶瓷高铬复合增强铸钢耐磨条板铸造工艺
Metal Matrix ceramic composite casting



证书号第2906543号

发明专利证书

发明名称：陶瓷高铬复合增强铸钢耐磨条/板铸造工艺

发明人：李刚

专利号：ZL 2015 1 0564378.9

专利申请日：2015年09月07日

专利权人：北京金煤创业进出口有限公司

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授权公告日：2018年05月01日　　授权公告号：CN 105108110 B

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2018年05月01日

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陶瓷高锰钢复合耐磨件铸造工艺
High Mn Steel Matrix ceramic composite casting

证书号第4307009号

发明专利证书

发明名称：陶瓷高锰钢复合耐磨件铸造方法

发明人：李刚

专利号：ZL 2018 1 1057291.2

专利申请日：2018年09月11日

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授权公告日：2021年03月19日　　授权公告号：CN 109128098 B

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2021年03月19日

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其他事项参见续页

产品及技术优势
THE ADVANTAGES OF PRODUCTS AND TECHNOLOGIES

产品工艺	主要复合材料产品	工艺先进性
耐热钢陶瓷复合铸造工艺（MMC-HT）	1. 耐热钢陶瓷复合预热器挂片 2. 耐热钢陶瓷复合烧结机篦条 3.耐热钢陶瓷复合垃圾焚烧炉篦条	世界首创的第四代耐热耐磨材料，成本低廉，减少合金使用量，大幅提高使用寿命，节省材料消耗，减少维修工作量。使用寿命是普通耐热钢产品的2-4倍
高铬陶瓷复合铸造工艺（MMC-Cr）	1.高铬复合陶瓷反击板锤 2.高铬复合陶瓷立磨辊套/衬板 3.高铬陶瓷复合球磨机衬板	世界最先进的耐磨材料，成本低廉，大幅提高使用寿命，节省材料消耗，减少维修工作量。使用寿命是普通高铬铸铁产品的2-3倍
合金钢陶瓷复合铸造工艺（MMC-M）	1. 合金钢基陶瓷复合立磨辊套/衬板 2. 合金钢基陶瓷复合球磨机衬板 3. 合金钢复合铸造可焊接耐磨板/条	世界最先进的耐磨材料，成本低廉，减少合金使用量，大幅提高使用寿命，节省材料消耗，减少维修工作量。使用寿命是普通球铁或普碳钢产品的3-4倍
高锰钢陶瓷复合铸造工艺(MMC-Mn）	1.陶瓷锰钢复合铸造齿板/扎臼壁 2.陶瓷增强高锰钢复合铸造斗齿	世界首创的第四代耐磨材料，成本低廉，减少合金使用量，大幅提高使用寿命，节省材料消耗，减少维修工作量。使用寿命是普通高锰钢产品的2-4倍

MMC
金属基陶瓷颗粒复合铸造生产技术
Metal matrix ceramic particle insert casting Technology

高铬陶瓷复合铸造耐磨材料（MMC-Cr）

High chrome ceramic insert composite wear-resistant castings

合金钢陶瓷复合铸造耐磨耐冲击材料（MMC-M）

Alloy steel ceramic insert composite wear-resistant castings

高锰钢陶瓷复合铸造耐磨材料（MMC-Mn）

High manganese ceramic insert composite wear-resistant castings

耐热钢陶瓷复合耐热抗磨材料（MMC-HT）

Heat resistant steel Ceramic insert Wear/Heat-resistant castings

双金属陶瓷复合（三相复合）铸造耐磨材料（MMC-B）

Bimetallic ceramic insert composite（three-phase composite）wear-resistant castings

MMC-Cr 高铬铸铁陶瓷复合耐磨材料

MMC-Cr （ High Chromium cast iron matrix ceramic insert casting wear-resistant material）

MMC-Cr （ High Chromium cast iron matrix ceramic insert casting wear-resistant material）

That is, the reinforcement phase - ceramic particles are fused and cast in the easily worn parts of metal parts with high chromium cast iron as the base material. The metal-ceramic composite layer is formed by the metallurgical combination of ceramic particles and casting alloy. The metallurgical bonding of ceramic particles with metal is realized by the heat of metal liquid. The hardness of ceramic-ceramic composite layer formed by ceramic particles and matrix metal shows a step distribution. The hardness of ceramic particles in the composite layer can reach 3-4 times of the hardness of high chromium cast iron material, so as to achieve the anti-wear effect; Compared with ordinary high chromium cast iron, the service life of the product is greatly extended.

The hardness of the High chromium iron ceramic composite layer is distributed in steps：

Ceramic particles hardness= HV2100

Hardness of metal around ceramic particles = 60-65HRC

Hardness of Basis material =High chromium iron = 58-62HRC

Metallography is Chromium-austenite and M7C3 eutectic carbide and chromium-troosite and M7C3 eutectic carbide

Suitable for use under low impact and high wear conditions

MMC-Cr 高铬铸铁陶瓷复合耐磨材料

即在高铬铸铁为基材的金属部件易磨损部位熔铸增强相-陶瓷颗粒.通过陶瓷颗粒与铸造合金的冶金结合来实现金属陶瓷复合并形成金属陶瓷复合层; 陶瓷颗粒与金属的冶金结合是通过金属液体的热量来实现的; 陶瓷颗粒与基体金属形成金属陶瓷复合层的硬度呈阶梯分布: 复合层中陶瓷颗粒的硬度可达高铬铸铁材料硬度的3-4倍，从而实现抗磨的效果;与普通高铬铸铁件相比，产品使用寿命大幅度延长。

高铬陶瓷复合层的硬度呈阶梯分布:

陶瓷颗粒硬度= HV2100

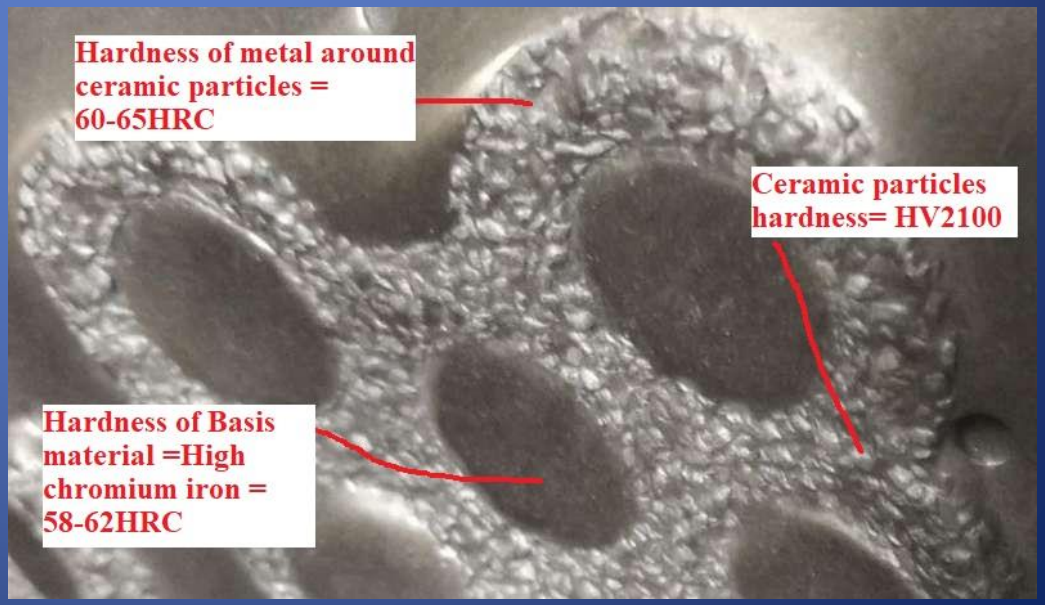
陶瓷颗粒周围的金属硬度= 60-65HRC

基材硬度=高铬铸铁= 58-62HRC

金相组织为铬-奥氏体和M7C3共晶碳化物，

铬-屈氏体和M7C3共晶碳化物

适合在低冲击和高磨损条件下使用



MMC-M 马氏体钢陶瓷复合耐磨材料
MMC-M (Martensite steel matrix ceramic Insert casting Wearparts）

MMC-M (Martensite steel matrix ceramic insert casting wear-resistant material）

That is, the reinforcement phase - ceramic particles are cast in the easily worn parts of the metal parts with martensitic steel as the base material. The metal-ceramic composite layer is formed by the metallurgical combination of ceramic particles and casting alloy. The metallurgical bonding of ceramic particles with metal is realized by the heat of metal liquid. The hardness of ceramic-ceramic composite layer formed by ceramic particles and matrix metal is distributed in a step: give full play to the characteristics of high strength and high hardness of martensitic steel, reduce the plastic deformation of metal parts, and improve the impact resistance; Combined with the high wear resistance of ceramic particles, the anti-wear performance of the working surface is improved. The result is a metal component that is both wear resistant and impact resistant. Due to the selection of martensitic steel as the base material, so that the composite material has a good welding, and processing properties, while the product is suitable for flame gas cutting, grinding wheel saw, shear, water cutting, plasma and other cutting methods, welding without preheating or subsequent heating treatment; Compared with ordinary high chromium cast iron, the service life of the product is greatly improved.

The hardness of the Martensite Steel ceramic insert composite layer is distributed in steps：

Ceramic particles hardness= HV2100

Hardness of metal around ceramic particles = 58-63HRC

Hardness of Basis material =Martensite Steel = 48-53HRC

Metallography is Martensite, residual austenite and undissolved carbide composition

It is suitable for use under high impact and high wear conditions and can be welded

MMC-M 马氏体钢陶瓷复合耐磨材料

即在马氏体钢为基材的金属部件易磨损部位熔铸增强相-陶瓷颗粒.通过陶瓷颗粒与铸造合金的冶金结合来实现金属陶瓷复合并形成金属陶瓷复合层; 陶瓷颗粒与金属的冶金结合是通过金属液体的热量来实现的; 陶瓷颗粒与基体金属形成金属陶瓷复合层的硬度呈阶梯分布: 充分发挥马氏体钢的高强度及高硬度特点，减少金属部件的塑性变形，提高抗冲击能力；结合陶瓷颗粒的高耐磨特性，提高工作面的抗磨性能；从而获得即耐磨且抗冲击的金属部件。因选用马氏体钢为基材，从而使复合材料具有很好的焊接, 及加工性能，同时产品适用火焰气割，砂轮锯，剪切，水割，等离子等多种切割方式切割，焊接时无需对其进行预热或后续加热处理; 与普通高铬铸铁件相比，产品使用寿命大幅度提高。

马氏体钢陶瓷复合层的硬度分布:

陶瓷颗粒硬度= HV2100

陶瓷颗粒周围的金属硬度= 60-65HRC

基体硬度=马氏体钢硬度= 48-53HRC

金相组织为马氏体、残余奥氏体和未溶碳化物组成

适合在高冲击、高磨损条件下使用，可焊接

MMC-Mn高锰钢陶瓷复合耐磨材料
MMC-Mn （High Manganese Steel Ceramic Insert casting wearparts）

MMC-Mn （High-manganese ceramic insert casting wear-resistant material）

That is, the reinforcement phase - ceramic particles are fused and cast in the easily worn parts of metal parts with high manganese steel as the base material. The metal-ceramic composite layer is formed by the metallurgical combination of ceramic particles and casting alloy. The metallurgical bonding of ceramic particles with metal is realized by the heat of metal liquid. The hardness of ceramic-ceramic composite layer formed by ceramic particles and matrix metal shows a step distribution. In the casting engineering, alloy elements in composite ceramic materials are used to refine the grain of high-manganese steel, improve the matrix properties of high-manganese steel, give full play to the work-hardening characteristics of high-manganese steel, reduce plastic deformation, and improve the low-impact wear resistance. Combined with the high wear resistance of the ceramic material, the wear resistance of the working surface is improved, so that the wear-resistant and impact-resistant material is obtained. The life of high manganese steel ceramic composite is greatly improved.

The hardness of the High manganese steel ceramic insert composite layer is distributed in steps：

Ceramic particles hardness= HV2100

Hardness of metal around ceramic particles = 60-65HRC

Basis material=High manganese steel =Hardness HB190-220

Impact hardness of High manganese steel = HB400-500

It is suitable for use under high impact and high wear conditions

MMC-Mn 高锰钢陶瓷复合耐磨材料

即在高锰钢为基材的金属部件易磨损部位熔铸增强相-陶瓷颗粒.通过陶瓷颗粒与铸造合金的冶金结合来实现金属陶瓷复合并形成金属陶瓷复合层; 陶瓷颗粒与金属的冶金结合是通过金属液体的热量来实现的; 陶瓷颗粒与基体金属形成金属陶瓷复合层的硬度呈阶梯分布: 在浇铸工程中利用复合陶瓷材料中的合金元素细化高锰钢晶粒，提高高锰钢基体性能，充分发挥高锰钢的加工硬化特点，减少塑性变形，提高低冲击耐磨能力； 结合陶瓷材料的高耐磨特性，提高工作面的抗磨性能，从而获得即耐磨且抗冲击的耐磨材料。高锰钢陶瓷复合材料的寿命大幅度提高。

高锰钢陶瓷复合层的硬度呈阶梯分布:

陶瓷颗粒硬度= HV2100

陶瓷颗粒周围的金属硬度= 60-65HRC

基材=高锰钢=硬度HB190-220

高锰钢冲击硬度= HB400-500

金相组织为奥氏体和碳化物

适合在高冲击、高磨损条件下使用

MMC-B 双金属陶瓷复合（三相复合）立磨辊套
MMC-B Bimetallic ceramic insert composite（three-phase composite）casting Roller
MMC GGG + High Chrome Cast Iron + ZTA Ceramic particles

DJM 选用球铁基高铬陶瓷复合材料，即：在高铬材料中熔铸陶瓷颗粒形成高铬陶瓷金属复合材料层，选用球铁为辊套基体，在辊套表面熔铸高铬陶瓷复合层，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，球铁高铬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，球铁高铬陶瓷辊套/衬板是高铬产品的三倍以上。

三相复合体的硬度呈阶梯分布:

基体GGG的硬度= HB 170-230、抗拉强度 σb (MPa)：≥500、 条件屈服强度 σ0.2 (MPa)：≥320 、 冲击韧性值 αkv (J/cm2)：≥9、

基体GGG的金相组织=珠光体+铁素体+球状石墨

陶瓷颗粒硬度= HV2100

陶瓷颗粒周围的金属硬度= 60-65HRC

高铬铸铁镶嵌条基材硬度= 58-62HRC

高铬铸铁镶嵌条金相组织为铬-奥氏体和M7C3共晶碳化物，铬-屈氏体和M7C3共晶碳化物

适合单重3吨以上的铸件，在低冲击和高磨损条件下使用

DJM selects a ductile iron based high chromium ceramic composite material, namely: High chromium ceramic metal composite material layer is formed by casting ceramic particles in high chromium material, ductile iron is selected as the matrix of roll sleeve, and high chromium ceramic composite layer is cast on the surface of roll sleeve. The wear resistance of this composite layer can reach 3-4 times that of high Cr material, and the thickness of this composite layer can be made to reach 1/3 of the thickness of the original spare part, and can be made according to the original wear curve. The average wear (wear depth) of the high chromium ceramic roller sleeve and liner is 2-4mm per 1000 hours, while the average wear (wear depth) of the high chromium roller sleeve and liner is 5-9mm per 1000 hours, and the high chromium ceramic roller sleeve/liner is more than three times that of the high chromium products.

The hardness of the three-phase composition castings shows a step distribution:

Hardness of matrix GGG = HB 170-230, tensile strength σb (MPa) : ≥500, conditional yield strength σ0.2 (MPa) : ≥320, impact toughness value αkv (J/cm2) : ≥9，

The metallographic structure of GGG is Pearlite + ferrite + spherical graphite

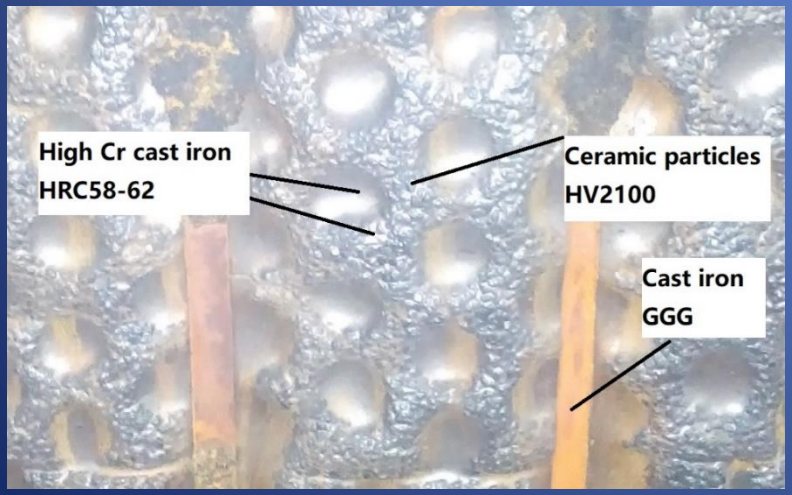
Ceramic particle hardness = HV2100

Metal hardness around ceramic particles = 60-65HRC

High chromium cast iron inlay strip hardness = 58-62HRC

The metallographic structure of high chromium cast iron is chrome-austenite and M7C3 eutectic carbide, chrome-troosite and M7C3 eutectic carbide

Suitable for Unit weight of castings over 3000kg，use under low impact and high wear conditions



（MMC-HT）耐热钢陶瓷复合耐热抗磨材料
（MMC-HT） Heat resistant steel Ceramic insert Wear/Heat-resistant castings

DJM 选用耐热钢为基材与陶瓷颗粒复合铸造制得耐热钢陶瓷复合耐热耐磨材料，耐热钢在高温环境下会在金属表面形成氧化层，氧化层的厚度，氧化层剥落面积，剥落时间决定了它的使用寿命，氧化层每剥落一层金属即耗损一层直至完全失效；弥散分布于基体金属的陶瓷颗粒能适当强化晶粒，减少晶界数量，在使用过程中阻碍热传导，隔绝热对流，分散热辐射，且将基体金属表面形成的氧化层分割成更小的氧化层区域，更小的氧化层区域更容易形成比较薄的氧化层，更小的氧化层区域每次剥落的氧化层更小，从而减缓基体金属氧化层的剥落时间，减少剥落面积及剥落厚度，提高有效使用寿命

耐热钢陶瓷复合材料的硬度呈阶梯分布:

基体耐热钢的硬度= ≤187HB、抗拉强度 σb (MPa)：≥590、 屈服强度 σ0.2 (MPa)：≥295、最高使用温度=1000℃。

基体耐热钢的金相组织=奥氏体型

陶瓷颗粒硬度= HV2100、陶瓷颗粒最高使用温度=1500° C、

陶瓷颗粒周围的金属硬度= 58-62HRC

复合层最高使用温度=1100-1200° C、

适合在低冲击和高温条件下使用

DJM uses heat-resistant steel as the substrate and ceramic particles composite casting to make heat-resistant steel ceramic composite heat-resistant wear-resistant material. Heat-resistant steel will form an oxide layer on the metal surface under high temperature environment. The thickness of the oxide layer, the area of the oxide layer and the peeling time determine its service life. The ceramic particles dispersed in the matrix metal can properly strengthen the grains, reduce the number of grain boundaries, hinder heat conduction, isolate heat convection, disperse heat radiation during use, and divide the oxide layer formed on the surface of the matrix metal into smaller oxide layer regions, smaller oxide layer regions are more likely to form a relatively thin oxide layer, and smaller oxide layer regions each time the peeling oxide layer is smaller. Thus, the peeling time of the metal oxide layer is slowed down, the peeling area and peeling thickness are reduced, and the effective service life is improved

the hardness of heat-resistant steel ceramic composite material is a step distribution:

hardness of matrix heat-resistant steel = ≤187HB, tensile strength σb (MPa) : ≥590, conditional yield strength σ0.2 (MPa) : ≥295,

heat-resistant steel microstructure = Austenitic

ceramic particle hardness = HV2100

ceramic particles around the metal hardness = 58-62HRC

suitable for use in low impact and high temperature conditions

金属陶瓷复合产品应用范围
Application range of cermet composite products

No.	应用行业	设备名称	产品描述	陶瓷复合产品材质	陶瓷复合产品使用效果	备注
1	露天矿 strip mine	电铲 excavator	电铲铲斗护角、护板、铲齿	高锰钢/合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/可焊接
		推土机 bulldozer	护角、护板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/可焊接
		矿车 bogie truck	护角、护板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/可焊接
	地下开采 underground mining	综采机	护板、衬板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/可焊接
		刮板运输机 scraper conveyer	刮板、槽包钢衬板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/可焊接
2	破碎 Crushing	溜槽 downspouting	溜槽衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		旋回破 gyratory crusher	动锥、破碎壁	高锰钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
		鄂破 Jaw crusher	齿板、侧板	高锰钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
		圆锥破 cone crusher	轧臼壁、破碎壁	高锰钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
		锤破 hammer crusher	锤头	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
		反击破 impact crusher	板锤	高铬陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
		辊压机 roller press	辊套、衬板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨
		料仓 stock bin	衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		自磨机（半自磨机）SAG	进出料溜槽、衬板、提升条	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨
		立式球磨机（塔磨机） Tower mill	衬板、螺旋衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		球磨机（棒磨机） Rod mill	衬板、隔仓板	合金钢陶瓷复合	使用寿命比常规产品提高两倍以上	耐磨
3	选矿 beneficiation	浮选机 flotation machine	衬板、螺旋搅拌叶片	高铬陶瓷复合	比常规产品提高一倍以上	耐蚀/耐磨
		渣浆泵 slurry pump	护板、叶轮、蜗壳	高铬陶瓷复合	比常规产品提高一倍以上	耐蚀/耐磨
4	烧结/焦化 Sintering/coking	烧结机 sintering machine	篦条	耐热高铬陶瓷复合	比常规产品提高一倍以上	耐热/耐蚀
		推焦机 coke pusher	推焦杆	耐热高铬/合金钢陶瓷复合	比常规产品提高一倍以上	耐热/耐磨
5	冶炼 smelting	高炉布料器溜槽	溜槽衬板	耐热高铬陶瓷复合	比常规产品提高一倍以上	耐热/耐磨
		高炉冲渣沟衬板	衬板	耐热高铬陶瓷复合	比常规产品提高一倍以上	耐热/耐磨

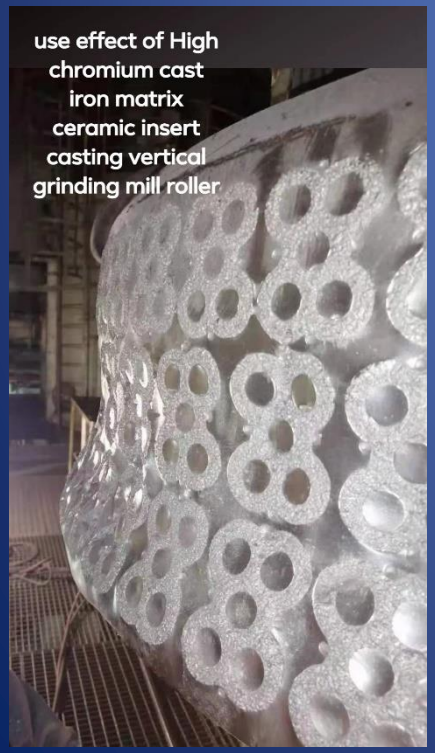
金属陶瓷复合产品应用范围
Application range of cermet composite products

No.	应用行业	设备名称	产品描述	陶瓷复合产品材质	陶瓷复合产品使用效果	备注
6	水泥厂 Cement plant	生料磨（立磨） Raw mill (vertical mill)	立磨辊套/衬板	球铁高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		生料磨（球磨机） Raw mill (ball mill)	球磨机筒体衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		水泥磨（立磨） Cement mill (vertical mill)	立磨辊套/衬板	球铁高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		水泥磨（球磨机） Cement mill (ball mill)	球磨机筒体衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		磨煤机（立磨） Coal mill	立磨辊套/衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		预热器 preheater	挂片	2520耐热钢陶瓷复合	比常规产品提高一倍以上	耐磨/耐热
		篦冷机 grate cooler	篦条/壁板	1.4777高铬耐热钢陶瓷复合	比常规产品提高一倍以上	耐磨/耐热
		锤破 Hammer crusher	锤头	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
			衬板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
7						
	热电厂 thermal power plant	磨煤机（立磨） Coal mill （vertical mill）	立磨辊套/衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨
			立磨辊套/衬板	球铁高铬陶瓷复合	比常规产品提高一倍以上	耐磨
		磨煤机（球磨机） Coal mill (ball mill)	球磨机筒体衬板	高铬陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
			球磨机筒体衬板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨
8	建筑垃圾处理 waste disposal	移动破 Mobile Crushing and Screening Plant	板锤	高铬陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
				合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
			衬板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨
			反击板	合金钢陶瓷复合	比常规产品提高一倍以上	耐磨/抗冲击
9	垃圾焚烧（发电） waste incineration	焚烧炉 destructor	2520篦条/壁板	耐热钢陶瓷复合	比常规产品提高一倍以上	耐热/耐蚀
			1.4777篦条/壁板	高铬耐热钢陶瓷复合	比常规产品提高一倍以上	耐热/耐磨
10						
	焦化/烧结	烧结机 sintering machine	2520篦条/壁板	耐热钢陶瓷复合	比常规产品提高一倍以上	耐热/耐磨
			1.4777篦条/壁板	高铬耐热钢陶瓷复合	比常规产品提高一倍以上	耐热/耐磨

金属陶瓷复合产品
Cermet composite products

金属陶瓷复合铸造立磨辊套使用效果
Use effect of Metal matrix ceramic insert casting Roller of Vertical Grinding Mill

- under normal conditions，
- The average wear depth of the high-chromium ceramic insert casting Roller and Bimetallic ceramic insert composite（three-phase composite）casting Roller of coal mill is 2-3mm per 1000 hours;
- The average wear depth of the high-chromium ceramic insert casting Roller and Bimetallic ceramic insert composite（three-phase composite）casting Roller of Raw mill is 4-6mm per 1000 hours;
- The average wear depth of the high-chromium ceramic insert casting Liner of coal mill is 1-2mm per 1000 hours;
- Bimetallic ceramic insert composite（three-phase composite）casting Roller is recommended when the weight of a single piece exceeds 3000kg
- 在正常情况下，磨煤机高铬陶瓷复合铸造辊套和双金属陶瓷复合(三相复合)铸造辊套的平均磨损深度为2 ~ 3mm / 1000小时;原料磨高铬陶瓷复合铸造辊和双金属陶瓷复合(三相复合)铸造辊套每1000小时的平均磨损深度为4 ~ 6mm;
- 磨煤机高铬陶瓷复合衬套每1000小时平均磨损深度为1 ~ 2mm;
- 单件重量超过3000kg时，推荐使用双金属陶瓷复合(三相复合)铸造辊套



立磨衬板使用实例
the use of examples-Mill Liner

- 物料=4500大卡煤（HGI=60）
- 进料粒度= 30-50mm
- 磨损形式=高应力碾碎式磨粒磨损（grinding abrasion）
- 使用者及设备=燃煤热电厂ZGM95G立磨碾底衬板
- 高铬陶瓷复合衬板使用寿命=1200-20000小时 每千小时磨耗=1-2mm
- 水泥生料使用寿命= 每千小时磨耗=2-3mm

金属基陶瓷复合立磨辊套

Roller of High Cr Cast Iron+ZTA Ceramic particles

Material	Cr26 辊套			Cr26 + Ceramic 辊套	
	使用寿命	产量		使用寿命	产量
石英砂	2000小时（个3月）	3000-4000吨/每套辊套		10个月以上 8000小时	12000吨/每套辊套
锂矿	2000-3000小时	3000-4000吨/每套辊套		8000小时以上	
煤	6000-8000小时			18000小时以上	
水泥生料	4000-6000小时			12000小时以上	

陶瓷金属复合球磨机衬板使用效果

using effect of Metal ceramic insert composite Ball mill liner

金属陶瓷复合球磨机衬板使用寿命对比统计表					
物料	使用工况	高锰钢衬板使用寿命		陶瓷复合衬板使用寿命	备注
煤炭	燃煤热电厂	2-4 年		8 年以上	
生料（石灰石）	水泥厂	7-8 个月		24 个月	
铁矿石	铁选厂	4-6 个月		18 个月	
铝矿	强化烧结	7-8 个月		24 个月	
铜矿	选厂	4-6 个月		18 个月	
金矿	选厂	4-6 个月		18 个月	

金属陶瓷复合铸造自(半)磨机衬板使用效果
use effect of Metal ceramic insert composite shell liner of SAG mill

金属陶瓷复合半自磨机衬板使用寿命对比统计表					
物料	使用工况	合金钢衬板使用寿命		陶瓷复合衬板使用寿命	备注
铁矿	铁选厂	4-6 个月		12 月以上	
铜矿	选厂	4-6 个月		12 月以上	
金矿	选厂	4-6 个月		12 月以上	

金属陶瓷复合铸造板锤使用效果
Use effect of Metal matrix ceramic insert casting composite Blow bar

under normal conditions，
the service life of the F60/5 + ceramic is more than 1 times of that of the common marteniste steel （F60/5）

the service life of the Cr27Mo + ceramic is more than 1 times of that of the common high-chromium
the service life of the Cr27Mo + ceramic is more than 1-2 times of that of the common marteniste steel
the service life of the Cr27Mo + ceramic is more than 2-3 times of that of the common high manganese steel

under normal conditions
Unit Feed size; over 500mm. selected high manganese steel + ceramic
Unit Feed size; max 550mm selected marteniste steel + ceramic
Unit Feed size; Max 350mm selected High Cr + ceramic
The type of material is uncertain, Materials contain metals, such as construction waste： selected marteniste steel + ceramic

金属陶瓷复合铸造锤头使用效果
Use effect of Metal matrix ceramic insert casting composite Hammer

- under normal conditions，the service life of high manganese steel ceramic insert casting hammer is more than 1 times of that of conventional Mn13 hammer
- the marteniste steel ceramic insert casting hammer is more than 1-2 times of that of conventional Mn13 hammer
- Bimetallic ceramic insert hammer is more than 2 -3 times of that of conventional Mn13 hammer

- 正常情况下，高锰钢陶瓷嵌套铸造锤的使用寿命是常规Mn13锤的1倍以上
- 马氏体钢陶瓷复合铸造锤是常规Mn13锤的1-2倍以上
- 双金属陶瓷复合锤是传统Mn13锤的2 -3倍以上

陶瓷复合雷蒙磨-磨辊-磨环使用效果
The use effect of Ceramic insert Raymond mill-Ring-roller

Material： Clay + ceramic brick
the service life of conventional Ring-roller（Mn13）is 600hour
the service life of high manganese steel ceramic inset Raymond mill-Ring-roller is 1150hour
the service life of high chromium ceramic inset Raymond mill-Ring-roller is 1900hour.

物料: 粘土+陶瓷砖
传统环辊(Mn13)的使用寿命为600小时
高锰钢陶瓷复合雷蒙磨环辊使用寿命为1150小时
高铬陶瓷复合雷蒙磨环辊使用寿命为1900小时

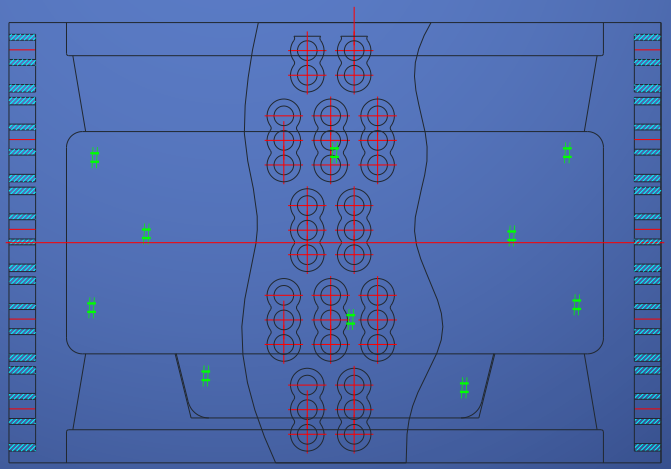
高锰钢陶瓷复合轧臼壁使用效果
Use effect Of High Manganese Steel Ceramic Insert Mantle / Bowl Liner

Cermet insert MANTLE / Bowl liner life comparison table					
Material		Mn18Cr2 service life		Mn18Cr2 + Ceramic service life	note
Iron ore	HP500	25days		Over 55days	
Granite	CH660	350-400hour		Over 800hour	
Copper ore	HP4	500-600hour		Over1000hour	
Gold ore	HP300	16days		Over35days	

MMC-SHS 金属陶瓷复合铸造辊压机辊套 使用效果

Use effect Of Metal ceramic insert composite roller of Rolling machine

辊压机辊套 roller of Rolling machine							
Material	铸钉辊 高速工具钢+钨钴钉 9万元/吨	铸钉辊 高速工具钢+TiC钉 6万元/吨	高铬+合金钢双金属离心铸造 2.8/吨	高锰钢离心铸造 1.8/吨	堆焊辊 4-5个月堆焊一次 可堆焊4-5次 120元/kg	KHD 锻造+钨钴钉 13万元/吨	陶瓷复合辊 5万元/吨
Iron ore	20000hour （3year）						20000hour （3year）
Raw material (limestone)	30000hour （5year）	20000hour （3year）	8000hour	3000hour	4 x 3000hour	20000hour （3year）	30000hour （5year）



谢谢！ / Thanks！

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