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

金属基纳米陶瓷（nm）复合铸造
MMC –Metal Matrix Ceramic(nm)composite casting

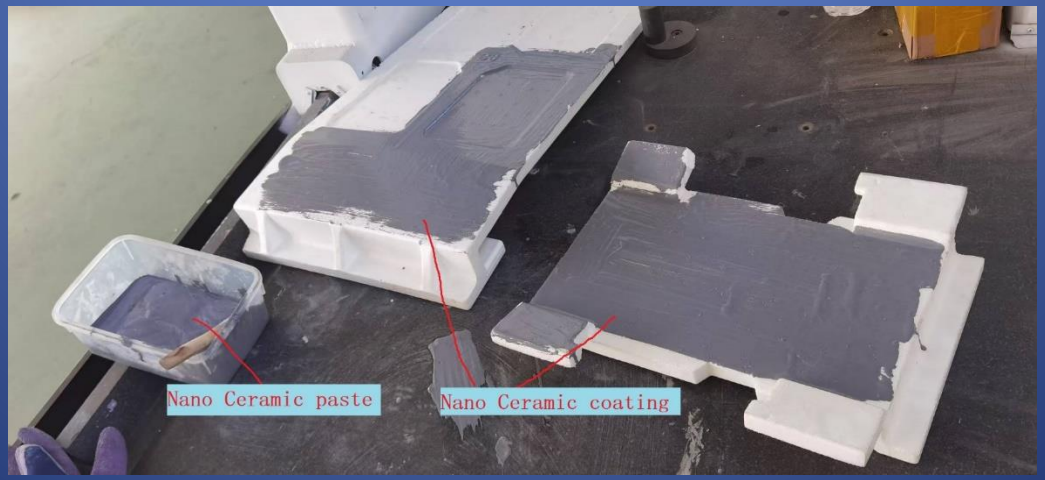
金属基纳米陶瓷复合铸造是将合金化后的陶瓷微粒与基体金属通过冶金铸造工艺熔融形成陶瓷微粒与金属的复合体，陶瓷微粒均匀弥散于金属中、原位生成A1203、实现金属基体与增强相的浸润和冶金结合；增强相陶瓷微粒形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相、**大幅提高基体金属的硬度/冲击韧性、屈服强度、耐磨性能、高温强度**Metal-based nano-ceramic composite casting is a process where alloyed ceramic particles are fused with the base metal through a metallurgical casting technique to form a composite of ceramic particles and metal. The ceramic particles are uniformly dispersed within the metal, in-situ generating Al2O3, achieving the infiltration and metallurgical bonding of the metal matrix and the reinforcing phase; the reinforcing ceramic particles form nano-crystalline nuclei, refine grains, purify the molten steel, desulfurize and deoxidize, and the reinforcing particles are uniformly dispersed within the matrix to form a hard phase**, significantly enhancing the hardness/impact toughness, yield strength, wear resistance, and high-temperature strength of the base metal**.

金属基纳米陶瓷（nm）复合铸造工艺
Metal matrix Ceramic (nm) composite castings Technology

金属基纳米陶瓷复合铸造是将合金化后的陶瓷微粒与基体金属通过冶金铸造工艺熔融形成陶瓷微粒与金属的复合体，陶瓷微粒均匀弥散于金属中、原位生成A1203、实现金属基体与增强相的浸润和冶金结合；增强相陶瓷微粒形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相大幅提高基体金属的硬度/冲击韧性、屈服强度、耐磨性能、高温强度；金属基纳米陶瓷复合铸造工艺操作简单、实用性强，无须对现有工艺做过多调整，只需将陶瓷微粒膏体涂敷于铸型表面烘干后即可浇铸成型，不影响后期机加工/热处理。广泛应用于耐热钢、高锰钢、合金钢等耐磨耐热材料；适用于水玻璃砂铸、树脂砂铸造、消失模铸造、离心铸造等工艺，适用产品包括：耐热钢挂片/蓖条/辊套/铸管、合金钢顶头/斗齿/锤头/轧辊/辊套、高锰钢齿板/轧臼壁、高铬渣浆泵叶轮/护板/蜗壳、等

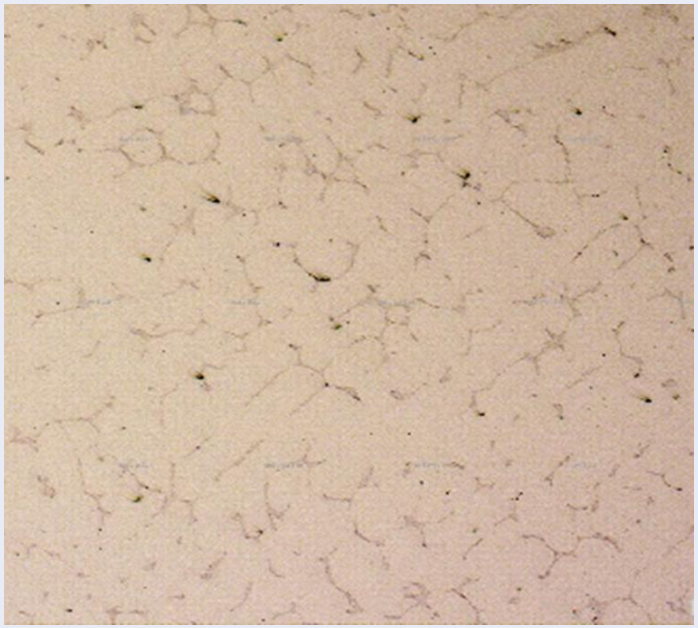
Metal-based nano-ceramic composite casting is a process where alloyed ceramic particles are fused with the base metal through a metallurgical casting technique to form a composite of ceramic particles and metal. The ceramic particles are uniformly dispersed within the metal, in-situ generating Al2O3, achieving the infiltration and metallurgical bonding of the metal matrix and the reinforcing phase; the reinforcing ceramic particles form nano-crystalline nuclei, refine grains, purify the molten steel, desulfurize and deoxidize, and the reinforcing particles are uniformly dispersed within the matrix to form a hard phase, significantly enhancing the hardness/impact toughness, yield strength, wear resistance, and high-temperature strength of the base metal.

The metal-based nano-ceramic composite casting technology is simple to operate and highly practical. It does not require excessive adjustments to the existing process. Just apply the ceramic particle paste to the surface of the mold, dry it, and then it can be cast into shape, without affecting the subsequent machining/heat treatment. It is widely applied to wear-resistant and heat-resistant materials such as heat-resistant steel, high manganese steel and alloy steel. It is applicable to processes such as sodium silicate sand casting, resin sand casting, lost foam casting, and centrifugal casting. The applicable products include: heat-resistant steel hanging plates/grates/roller sleeves/cast pipes, alloy steel top heads/bucket teeth/hammer heads/rolls/roller sleeves, high manganese steel tooth plates/mill walls, high chromium slurry pump impellers/guard plates/volutes, etc

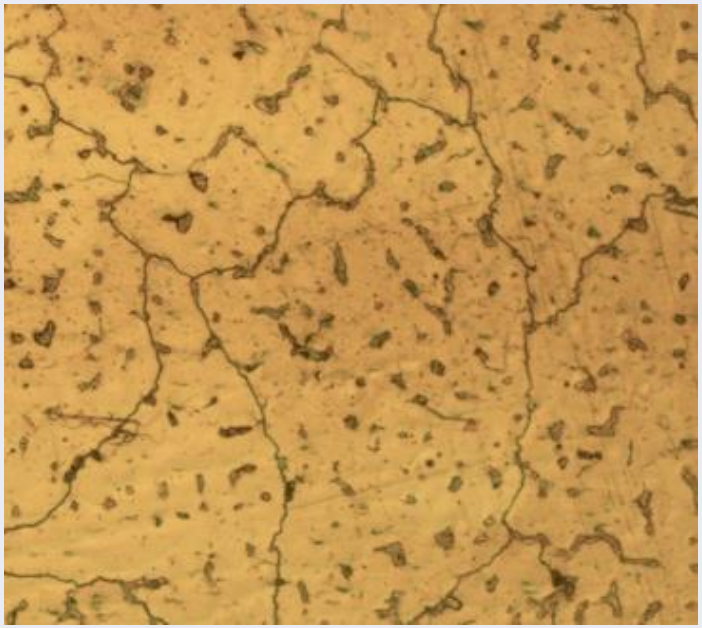


陶瓷复合耐热钢Cr2520机械性能对比
Comparison of mechanical properties of ceramic composite Heat-resistant steel Cr2520

Cr2520铸态 As-cast Cr2520 1150x1h固溶水冷、850x6h时效炉冷500出炉空冷	850度蠕变寿命提高2-3倍、1150度抗氧化提高40%、Ce30 10kgs、NiY8(8kg)提高冷热交变强度30% 1150x1h固溶水冷、700x4h时效出炉风冷	Cr2520陶瓷复合铸态 Cr2520 Ceramic(nm) Composite As-cast DJM-2-1# Al陶瓷膏
550-620MPa	Tensile Rm： Mpa	850-1000MPa
235-270Mpa	Yield Rp： Mpa	500-650MPa
20-30J/cm2	Impact Akv	6-15J/CM2
HBW230-280	Hardness： HB	HB360-420
20-40Mpa	Rp 1000℃高温屈服	74.27Mpa / 210Mpa
40-50Mpa	Rm 1000℃高温拉伸	96.7Mpa / 260Mpa
0.09mg/cm2	800℃,32小时氧化增重实验	0.043mg/cm2



C:0.3-0.5
Al： >0.2
Ce： 0.3
Cr:19-21
Ni： 24-26
Mn：<1.5
Si：1.0-2.5
S:<0.030
P:<0.035



陶瓷（nm）复合铸造预热器耐热钢挂片
Heat-resistant steel Ceramic(nm) composite castings Preheater liner

MMC Cr2520 + FeCe30 + NiY8+ DJM-2# Al陶瓷膏、1100x2h水冷固溶+700x6h时效（出炉风冷）

- 耐热钢基陶瓷复合铸造预热器挂片，利用增强相（陶瓷）微粒形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相***大幅提高耐热钢的屈服强度、耐磨性能、高温强度、耐腐蚀性能***；充分发挥增强相的耐热抗氧化耐磨性能从而满足恶劣工况条件下的耐热抗氧化耐磨要求
- The heat-resistant steel-based ceramic composite casting preheater liner utilizes the micro-particles of the reinforcing phase (ceramic) to form nanocrystalline nuclei, refine grains, purify the molten steel, desulfurize and deoxidize, and evenly disperse the reinforcing phase micro-particles in the matrix to form a hard phase, ***significantly enhancing the yield strength, wear resistance, high-temperature strength, and corrosion resistance of the heat-resistant steel. It fully exploits the heat resistance, oxidation resistance***, and wear resistance of the reinforcing phase to meet the requirements of heat resistance, oxidation resistance, and wear resistance under harsh working conditions.





陶瓷（nm）复合离心铸造耐热钢管/辊套
Ceramic (nm) composite centrifugal cast heat-resistant steel pipe/roller sleeve
MMC Cr2520 + FeCe30 + NiY8+ DJM-5-1# AlMg陶瓷膏

- 耐热钢基陶瓷复合离心铸造管/辊套，利用增强相（陶瓷微粒）形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相***大幅提高耐热钢的屈服强度、耐磨性能、高温强度、耐腐蚀性能***；充分发挥增强相的耐热抗氧化耐磨性能从而满足恶劣工况条件下的耐热抗氧化耐磨要求

- The heat-resistant steel-based ceramic composite centrifugal casting pipe/roller utilizes the micro-particles of the reinforcing phase (ceramic partical) to form nano crystalline nuclei, refine grains, purify the molten steel, desulfurize and deoxidize, and evenly disperse the reinforcing phase micro-particles in the matrix to form a hard phase, ***significantly enhancing the yield strength, wear resistance, high-temperature strength, and corrosion resistance of the heat-resistant steel. It fully exploits the heat resistance, oxidation resistance***, and wear resistance of the reinforcing phase to meet the requirements of heat resistance, oxidation resistance, and wear resistance under harsh working conditions.







陶瓷（nm）复合离心铸造耐热钢管/辊套

Ceramic (nm) composite centrifugal cast heat-resistant steel pipe/roller sleeve

MMC Cr2520 + FeCe30 + NiY8+ DJM-5-1# AlMg陶瓷膏

陶瓷复合离心铸造管/辊套，利用增强相（陶瓷微粒）形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相***大幅提高耐热钢的屈服强度、耐磨性能、高温强度、耐腐蚀性能***；充分发挥增强相的耐热抗氧化耐磨性能从而满足恶劣工况条件下的耐热抗氧化耐磨要求

The heat-resistant steel-based ceramic composite centrifugal casting pipe/roller utilizes the micro-particles of the reinforcing phase (ceramic partical) to form nano crystalline nuclei, refine grains, purify the molten steel, desulfurize and deoxidize, and evenly disperse the reinforcing phase micro-particles in the matrix to form a hard phase, ***significantly enhancing the yield strength, wear resistance, high-temperature strength, and corrosion resistance of the heat-resistant steel. It fully exploits the heat resistance, oxidation resistance***, and wear resistance of the reinforcing phase to meet the requirements of heat resistance, oxidation resistance, and wear resistance under harsh working conditions.





Cr2520铸态 As-cast Cr2520		Cr2520陶瓷复合铸态 Cr2520 Ceramic(nm) Composite As-cast
520MPa	Tensile Rm：Mpa	586MPa
205Mpa	Yield Rp：Mpa	365MPa
50-100J/cm2 KW2	Impact	14.45J/CM2 KV2
HV≤200	Hardness：HB	HB330
20-40Mpa	Rp 1000℃高温屈服	74.27Mpa
40-50Mpa	Rm 1000℃高温拉伸	96.7Mpa
0.09mg/cm2	800℃,32小时氧化增重实验	0.043mg/cm2

陶瓷（nm）复合离心铸造耐热钢管/辊套

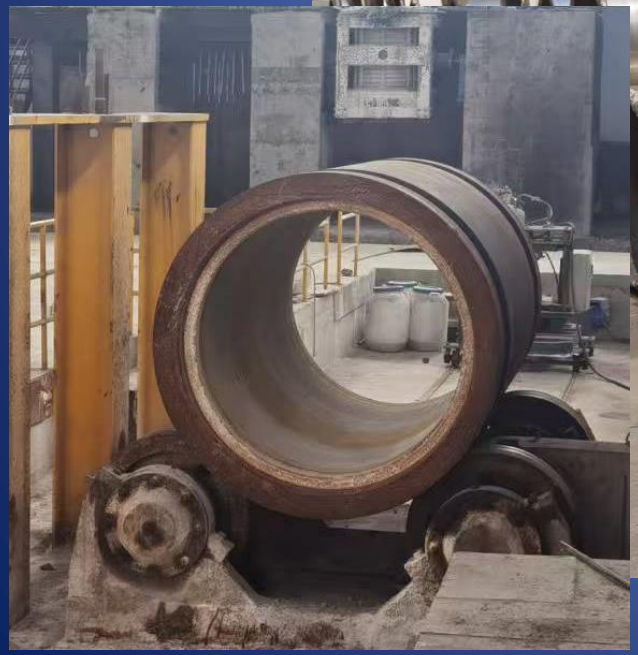
Ceramic (nm) composite centrifugal cast heat-resistant steel pipe/roller sleeve

MMC Cr2520 + FeCe30 + NiY8+ DJM-5-1# AlMg陶瓷膏 1100x2h水冷固溶+700x6h时效（出炉风冷）

陶瓷复合离心铸造管/辊套，利用增强相（陶瓷微粒）形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相***大幅提高耐热钢的屈服强度、耐磨性能、高温强度、耐腐蚀性能***；充分发挥增强相的耐热抗氧化耐磨性能从而满足恶劣工况条件下的耐热抗氧化耐磨要求

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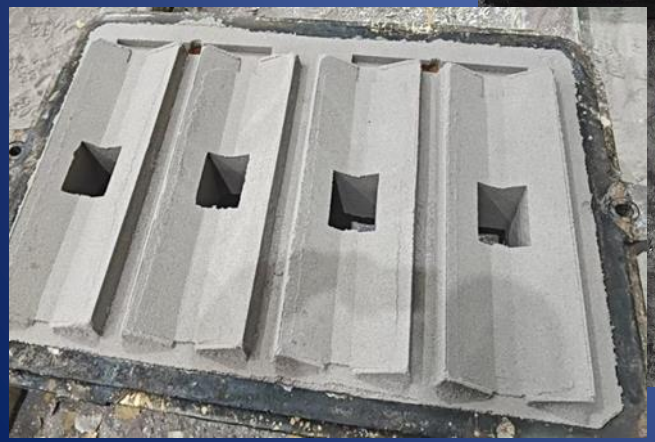
陶瓷（nm）复合铸造耐热钢侧导板

side guide plate Cr28Ni48W5 + NiY8（8kg）+ FeCe30 10kg + DJM-2# Ceramic

- 金属基纳米陶瓷复合铸造技术操作简单、实用性强，无须对现有工艺做过多调整，只需将陶瓷微粒膏体涂敷于铸型表面烘干后即可浇铸成型，不影响后期机加工/热处理。广泛应用于耐热钢、高锰钢、合金钢等耐磨耐热材料；适用于水玻璃砂铸、树脂砂铸造、消失模铸造、离心铸造等工艺，适用产品包括：耐热钢挂片/蓖条/辊套/铸管、合金钢顶头/斗齿/锤头/轧辊/辊套、高锰钢齿板/轧臼壁、高铬渣浆泵叶轮/护板/蜗壳、等
- The metal-based nano-ceramic composite casting technology is simple to operate and highly practical. It does not require excessive adjustments to the existing process. Just apply the ceramic particle paste to the surface of the mold, dry it, and then it can be cast into shape, without affecting the subsequent machining/heat treatment. It is widely applied to wear-resistant and heat-resistant materials such as heat-resistant steel, high manganese steel and alloy steel. It is applicable to processes such as sodium silicate sand casting, resin sand casting, lost foam casting, and centrifugal casting. The applicable products include: heat-resistant steel hanging plates/grates/roller sleeves/cast pipes, alloy steel top heads/bucket teeth/hammer heads/rolls/roller sleeves, high manganese steel tooth plates/mill walls, high chromium slurry pump impellers/guard plates/volutes, etc





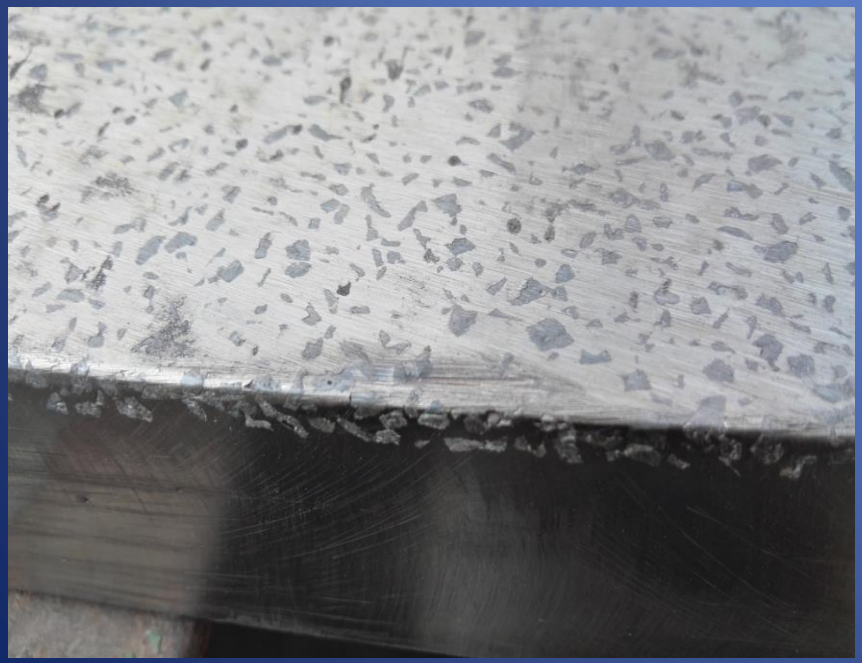




金属基纳米陶瓷复合铸造可焊接耐磨板
Metal Matrix ceramic(nm) composite casting Liner
（weldability wear-resistant plate)

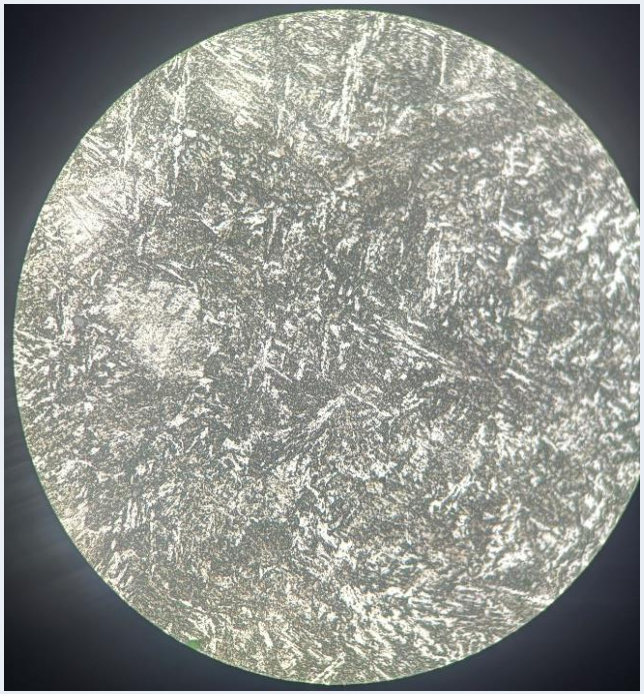
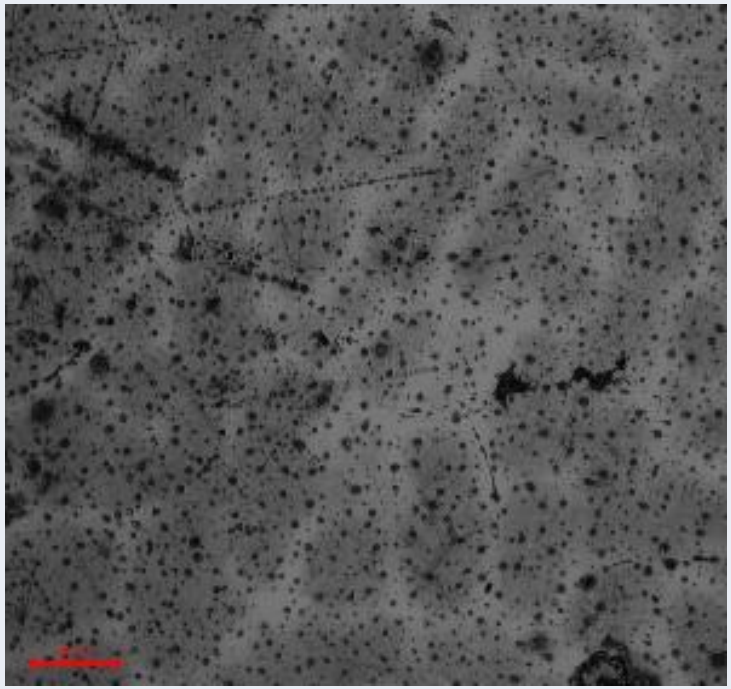
可焊接耐磨条/板是一种以合金钢为基材的陶瓷复合耐磨材料，即在合金钢材料表面熔铸陶瓷颗粒形成陶瓷金属复合材料层，这层复合层的耐磨性能可达高Cr材料的1-3倍，同时这一复合层的厚度可制成达到原备件厚度的1/3，并可根据原磨损曲线有针对性的制作，因选用合金钢为基材，从而使合金钢底座具有很好的焊接性能，又可以承担高冲击强度。陶瓷的硬度提供了最大限度的耐磨性，同时，合金钢底座能吸收高冲击强度，产品易于使用，适用火焰气割，砂轮锯，剪切，水割，等离子等多种切割方式切割，焊接到曲面内外轮廓表面上，无需对其进行预热或后续加热处理; 体积小，便于运输，不需要过多的焊接时间，是理想的小区域磨损修复耐磨材料; 我们能为客户提供个性化定做。

Weldable wear-resistant strip/plate is a kind of ceramic composite wear-resistant material based on alloy steel, that is, cast ceramic particles on the surface of alloy steel material to form ceramic metal composite material layer, the wear resistance of this layer of 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, because the selection of alloy steel as the base material, so that the alloy steel base has good welding performance, but also can bear high impact strength. The hardness of the ceramic provides maximum wear resistance. At the same time, the alloy steel base can absorb high impact strength, and the product is easy to use. It is suitable for flame gas cutting, grinding wheel sawing, shear, water cutting, plasma and other cutting methods, and is welded to the internal and external contours of the curved surface without preheating or subsequent heating treatment. Small size, easy to transport, does not require too much welding time, is the ideal small area wear repair wear-resistant materials; We can provide customers with personalized customization.





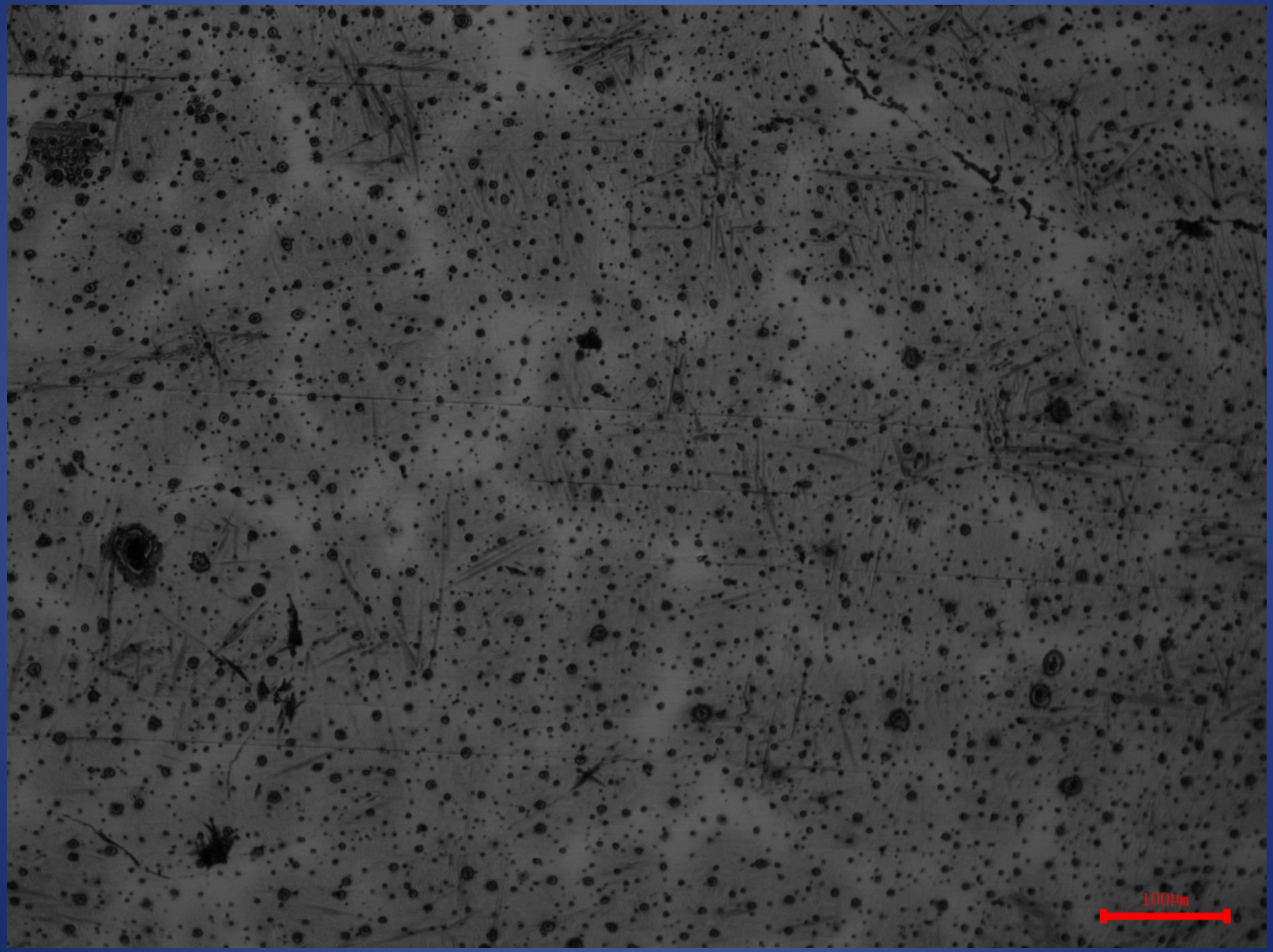
合金钢陶瓷（nm）复合合金钢机械性能对比
Comparison of mechanical properties of ceramic (nm) composite alloy steel

F40/3铸态 / 热处理 As-cast F40/3 / Heat Treated		F40/3纳米陶瓷复合铸态 / 热处理 F40/3 Ceramic Particle Composite as-Cast / Heat-Treated DJM-2-1# Al陶瓷膏、960x3h风冷，320x2h回火
851Mpa / 1145MPa	Tensile Rm： Mpa	713Mpa / 1080Mpa
Mpa / 680MPa	Yield Re： Mpa	Mpa / 650Mpa
45J/CM2 / 50J/cm2	Impact： Akv	36J/CM2 / 68J/cm2
40HRC / 53HRC	Hardness： HRC	50HRC / 55HRC
	C:0.35-0.45 Al： 0.2 Ce：0.3 Cr:2.5--3.5 Mo:0.3-0.5 Ni:<0.5% Mn：<0.8 Si：<0.5 S: < 0.3 P: < 0.35	

纳米陶瓷（nm）与金属界面金相

Ceramics particle and metal interface metallography of Alloy Steel

DJM-2# Al陶瓷膏



合金钢陶瓷复合层硬度
Hardness of ceramic composite layer of alloy steel

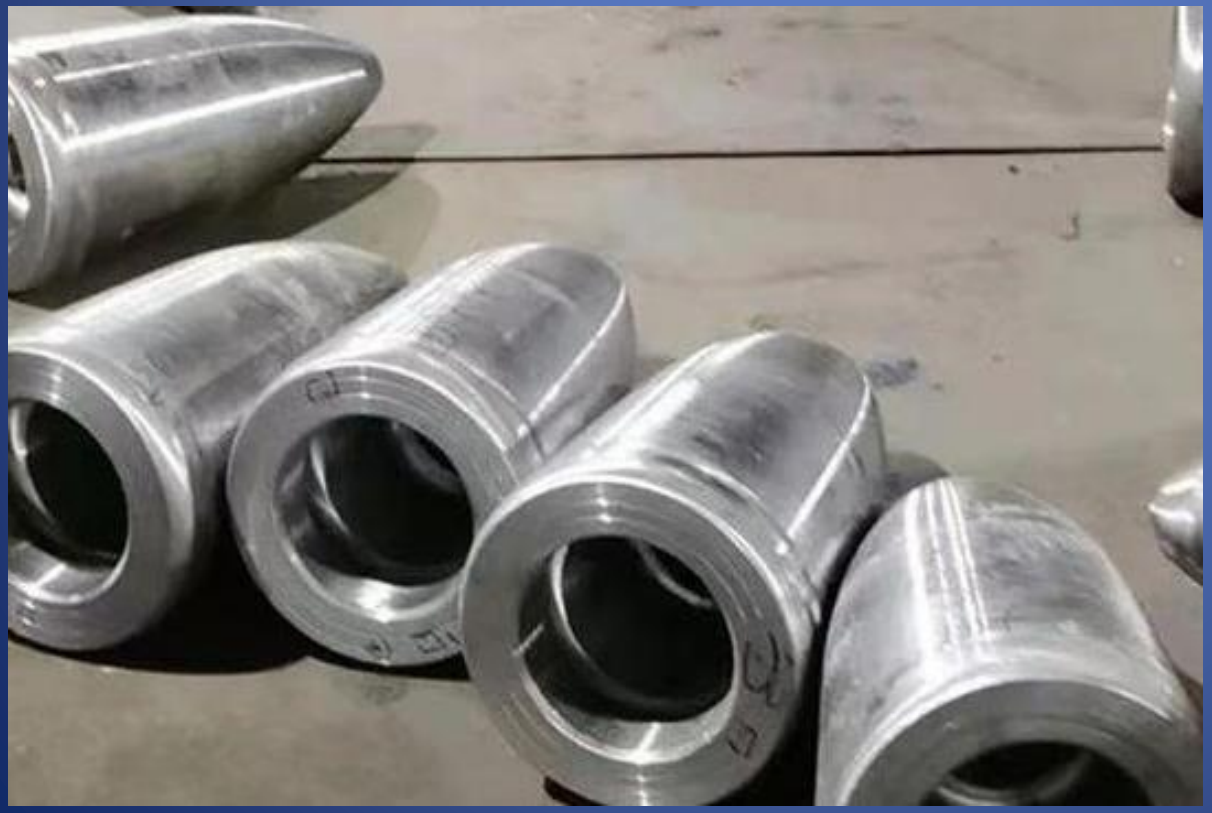


陶瓷（nm）复合铸造合金钢穿孔顶头

Seamless pipe perforated head

20CrNi4 + FeCe30 + DJM-2# Ceramic + NiY8(8kg)

- 金属基纳米陶瓷（nm）复合铸造技术操作简单、实用性强，无须对现有工艺做过多调整，只需将陶瓷微粒膏体涂敷于铸型表面烘干后即可浇铸成型，不影响后期机加工/热处理。广泛应用于耐热钢、高锰钢、合金钢等耐磨耐热材料；适用于水玻璃砂铸、树脂砂铸造、消失模铸造、离心铸造等工艺，适用产品包括：耐热钢挂片/蓖条/辊套/铸管、合金钢顶头/斗齿/锤头/轧辊/辊套、高锰钢齿板/轧臼壁、高铬渣浆泵叶轮/护板/蜗壳、等
- The metal-based nano-ceramic (nm) composite casting technology is simple to operate and highly practical. It does not require excessive adjustments to the existing process. Just apply the ceramic particle paste to the surface of the mold, dry it, and then it can be cast into shape, without affecting the subsequent machining/heat treatment. It is widely applied to wear-resistant and heat-resistant materials such as heat-resistant steel, high manganese steel and alloy steel. It is applicable to processes such as sodium silicate sand casting, resin sand casting, lost foam casting, and centrifugal casting. The applicable products include: heat-resistant steel hanging plates/grates/roller sleeves/cast pipes, alloy steel top heads/bucket teeth/hammer heads/rolls/roller sleeves, high manganese steel tooth plates/mill walls, high chromium slurry pump impellers/guard plates/volutes, etc





合金钢陶瓷(nm)复合铸造斗齿/铲齿

Excavator teeth / Shovel teeth of F40/3 Ceramic(nm) composite casting

F60/5 + DJM-2# Al陶瓷膏 + FeCe30 + NiY8(8kg)

合金钢基陶瓷复合铸造铲齿，利用增强相（陶瓷）微粒形成纳米晶核、细化晶粒、净化钢液、脱硫脱氧、增强相微粒均匀弥散于本体形成硬质相***大幅提高合金钢的硬度/冲击韧性、耐磨性能、高温强度；冲击值超过50J/CM2，抗冲击，无断裂风险，塑性变形小，可焊接再加工***，使用寿命是传统产品的1倍以上

Alloy steel-based ceramic composite casting shovel teeth, by using the micro-particles of the reinforcing phase (ceramic) to form nanocrystalline nuclei, refine the grains, purify the molten steel, desulfurize and deoxidize, and evenly disperse the reinforcing phase micro-particles in the matrix to form a hard phase, ***significantly enhance the hardness/impact toughness, wear resistance, and high-temperature strength of the alloy steel; the impact value exceeds 50J/CM2, it is resistant to impact, has no risk of fracture, has small plastic deformation, is weldable and reprocessable,*** and its service life is more than twice that of traditional products.





合金钢陶瓷（nm）复合铸造耐磨衬板

Alloy steel Ceramic (nm) composite castings wear resistant Liner

F40/3 + FeCe30 + DJM-1#Ceramic Particle + DJM-2#Ceramic + NiY8(8kg)

DJM采用金属陶瓷颗粒为增强相、合金钢为基体金属、利用纳米陶瓷提高耐磨衬板金属基体的强度，在耐磨衬板易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而获得***硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击值超过50J/CM2，抗冲击，无断裂风险，塑性变形小，可焊接再加工***，使用寿命是传统产品的1-3倍

DJM uses cermet particles as the reinforcement phase and alloy steel as the matrix metal, and uses Nano Ceramic to improve the strength of the metal matrix of the wear-resistant lining plate. The reinforcement phase - ceramic particle preform is cast in the wear-resistant lining plate. In the process of melting and casting, the matrix metal and alloyed ceramic particles achieve metallurgical combination under the action of metal liquid at high temperature, so as to obtain the metal base ceramic composite layer ***with a ladder of hardness distribution, which greatly improves the wear resistance, the impact value exceeds 50J/CM2, the impact resistance, no fracture risk, the plastic deformation is small, Weldable and reprocessable***、and the service life is 1-3 times that of traditional products





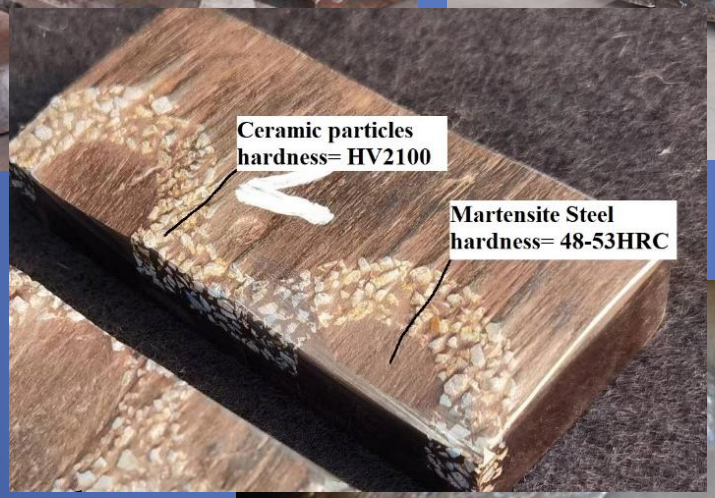
合金钢陶瓷复合铸造耐磨衬板

Alloy steel Ceramic composite castings wear resistant Liner

F40/3 + FeCe30 + DJM-1#Ceramic Particle + DJM-2#Ceramic + NiY8(8kg)













合金钢陶瓷复合板锤/锤头

Alloy Steel Matrix ceramic composite Blow Bar/ Hammer

F40/3 + DJM-1#Ceramic Particle + DJM-2#Ceramic + FeCe30 + NiY8(8kg)

DJM采用金属陶瓷颗粒为增强相、合金钢为基体金属、利用纳米陶瓷及稀土细化晶粒、提高抗冲击性能、提高金属基体的强度，在耐磨衬板易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而***获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击值可达100J/CM2以上，抗冲击，无断裂风险，塑性变形小，可焊接再加工***，使用寿命是传统产品的1-3倍

DJM uses cermet particles as the reinforcement phase and alloy steel as the matrix metal, and uses Nano Ceramic to improve the strength of the metal matrix of the wear-resistant lining plate. The reinforcement phase - ceramic particle preform is cast in the wear-resistant lining plate. In the process of melting and casting, the matrix metal and alloyed ceramic particles achieve metallurgical combination under the action of metal liquid at high temperature, so as to obtain the metal base ceramic composite layer ***with a ladder of hardness distribution, which greatly improves the wear resistance, the impact over 100J/CM2、the impact resistance, no fracture risk, the plastic deformation is small, Weldable and reprocessable***、and the service life is 1-3 times that of traditional products





MMC 高强度合金钢陶瓷复合辊套

Metal matrix Ceramic insert casting roller

F40/3 + DJM-1#Ceramic Particle + DJM-2#Ceramic + FeCe30 + NiY8(8kg)













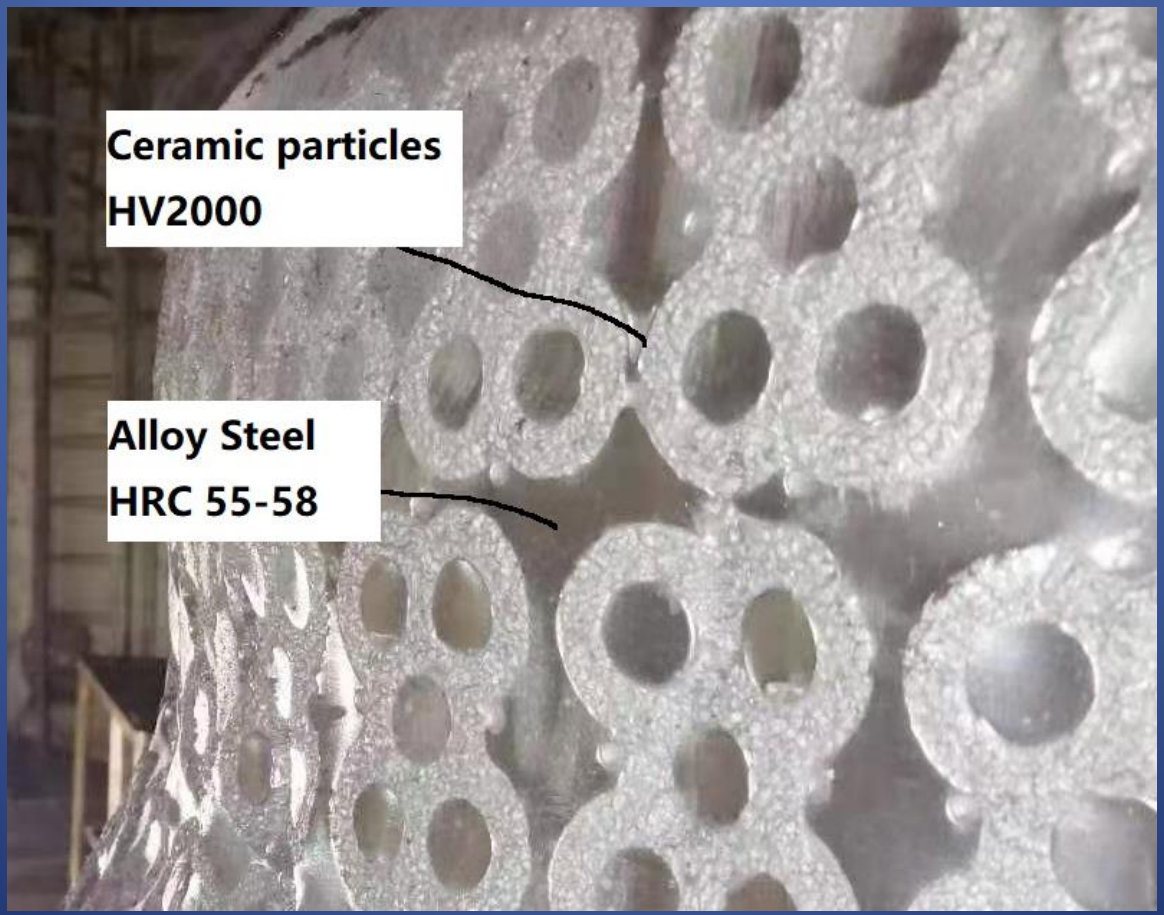
合金钢陶瓷复合铸造立磨辊套

Roller of Alloy Steel Ceramic composite casting

F40/3 + DJM-1#Ceramic Particle + DJM-2#Ceramic + FeCe30 + NiY8(8kg)

DJM采用金属陶瓷颗粒为增强相、合金钢为基体金属、利用纳米陶瓷提高金属基体的强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而***获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击值超过50J/CM2，抗冲击，无断裂风险，塑性变形小，可焊接再加工***，使用寿命是传统产品的1-3倍

DJM uses cermet particles as the reinforcement phase and alloy steel as the matrix metal, and uses Nano Ceramic to improve the strength of the metal matrix of the wear-resistant wearparts. The reinforcement phase - ceramic particle preform is cast in the wear-resistant wearparts. In the process of melting and casting, the matrix metal and alloyed ceramic particles achieve metallurgical combination under the action of metal liquid at high temperature, so as to obtain the metal base ceramic composite layer ***with a ladder of hardness distribution, which greatly improves the wear resistance, the impact value exceeds 50J/CM2, the impact resistance, no fracture risk, the plastic deformation is small, Weldable and reprocessable***、and the service life is 1-3 times that of traditional products



合金钢陶瓷复合铸造立磨配件

Alloy ceramic composite casting vertical grinding mill spare parts

F40/3 + DJM-1#Ceramic Particle + DJM-2#Ceramic + FeCe30 + NiY8(8kg)

DJM采用金属陶瓷颗粒为增强相、合金钢为基体金属、利用纳米陶瓷提高金属基体的强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击值超过50J/CM2，抗冲击，无断裂风险，塑性变形小，可焊接再加工，使用寿命是传统产品的1-3倍

DJM uses cermet particles as the reinforcement phase and alloy steel as the matrix metal, and uses Nano Ceramic to improve the strength of the metal matrix of the wear-resistant wearparts. The reinforcement phase - ceramic particle preform is cast in the wear-resistant wearparts. In the process of melting and casting, the matrix metal and alloyed ceramic particles achieve metallurgical combination under the action of metal liquid at high temperature, so as to obtain the metal base ceramic composite layer with a ladder of hardness distribution, which greatly improves the wear resistance, the impact value exceeds 50J/CM2, the impact resistance, no fracture risk, the plastic deformation is small, Weldable and reprocessable、 and the service life is 1-3 times that of traditional products







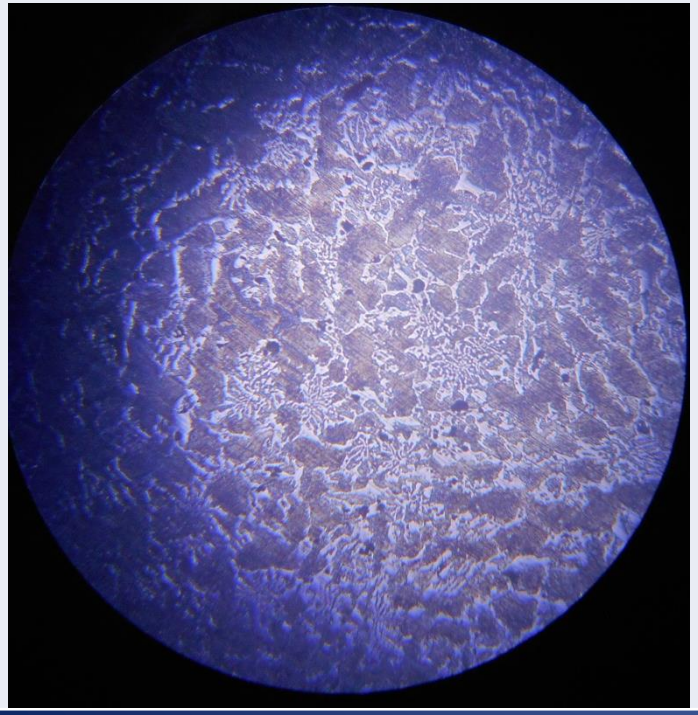




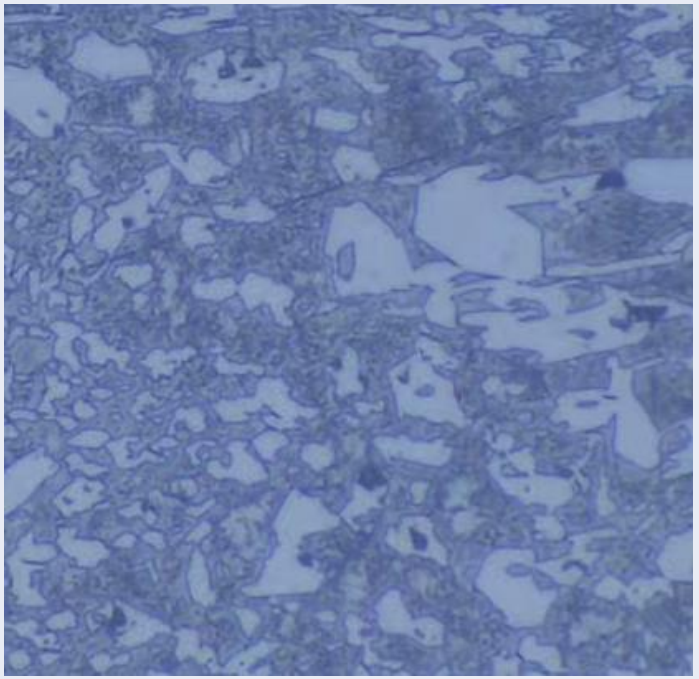


陶瓷（nm）复合高铬铸铁Cr2021机械性能对比
Comparison of mechanical properties of ceramic (nm) composite High Chrome iron Cr2021

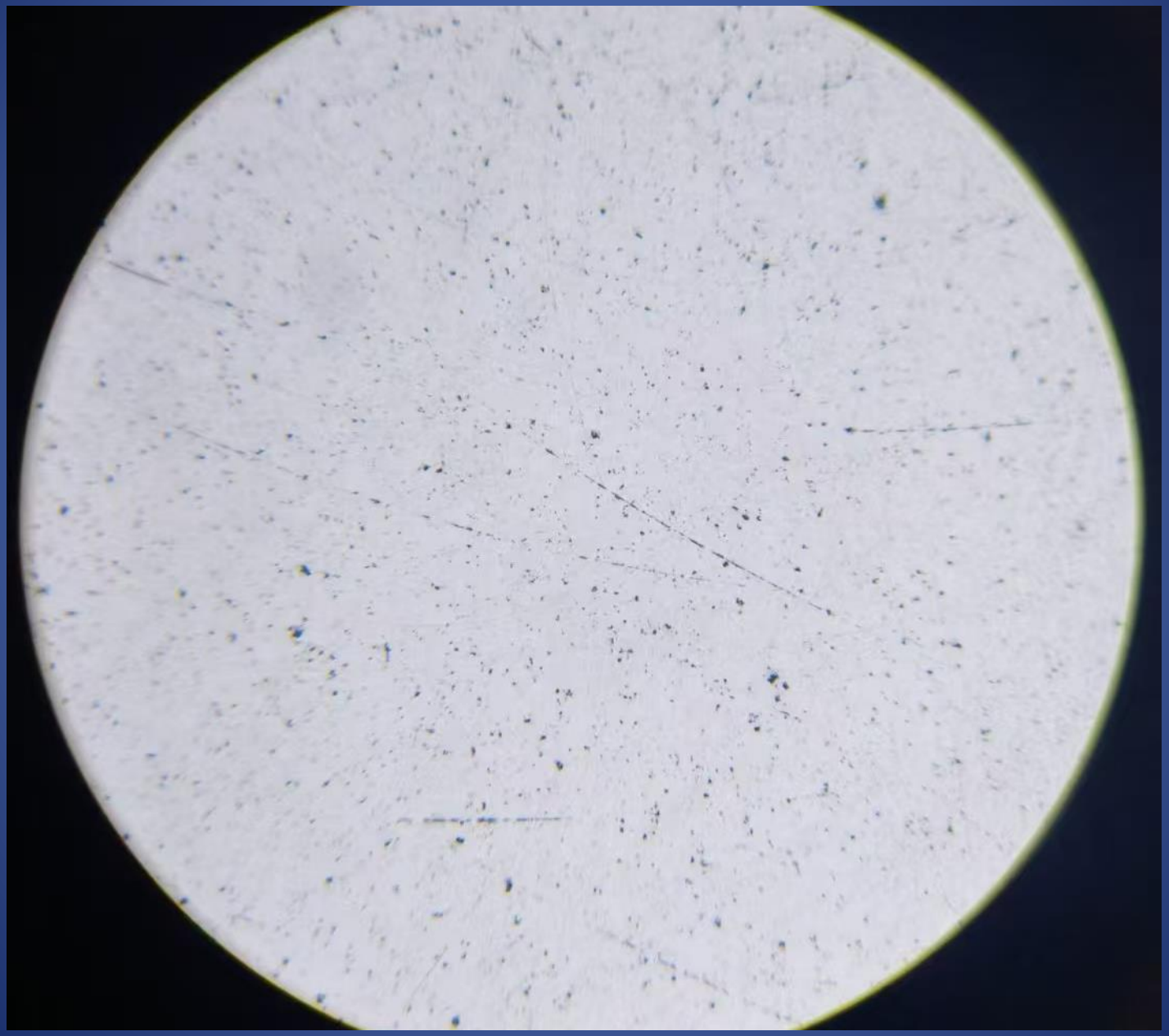
Cr2021铸态 / 热处理 As-cast Cr2021 / Heat-Treated		Cr2021纳米陶瓷复合铸造 Cr2021 Ceramic Particle Composite casting DJM-2-1# Al陶瓷膏+FeCe30（10kg）
480-550MPa / 600-650MPa	Tensile Rm： Mpa	643MPa
400Mpa / 500-700Mpa	Yield Re： Mpa	505MPa
1-3J/cm2 / 3-6J/CM2	Impact： Kw2 (KV2)	10-11J/CM2 （3-4J/CM2 KV2）
HRC53 / HRC58	Hardness： HRC	58HRC



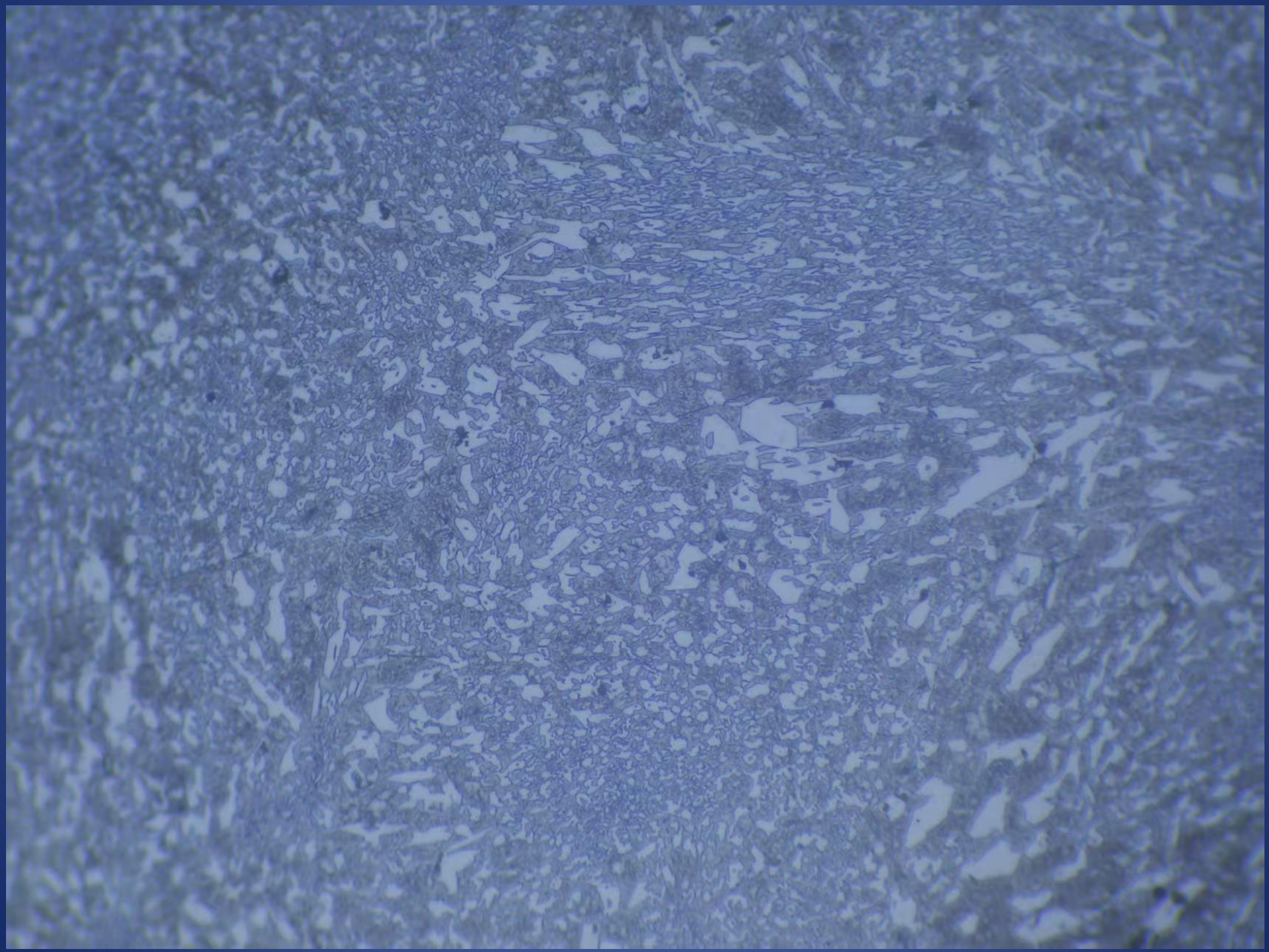
C:2.3-2.9
Al：0.2
Ce：0.3
Cr:18-22
Mo:0.3
Ni:0.5
Mn：0.8
Si：0.5
S:<0.06
P:<0.10



陶瓷（nm）复合高铬铸铁Cr2021机械性能对比
Metallographic of ceramic (nm) composite High Chrome iron Cr2021

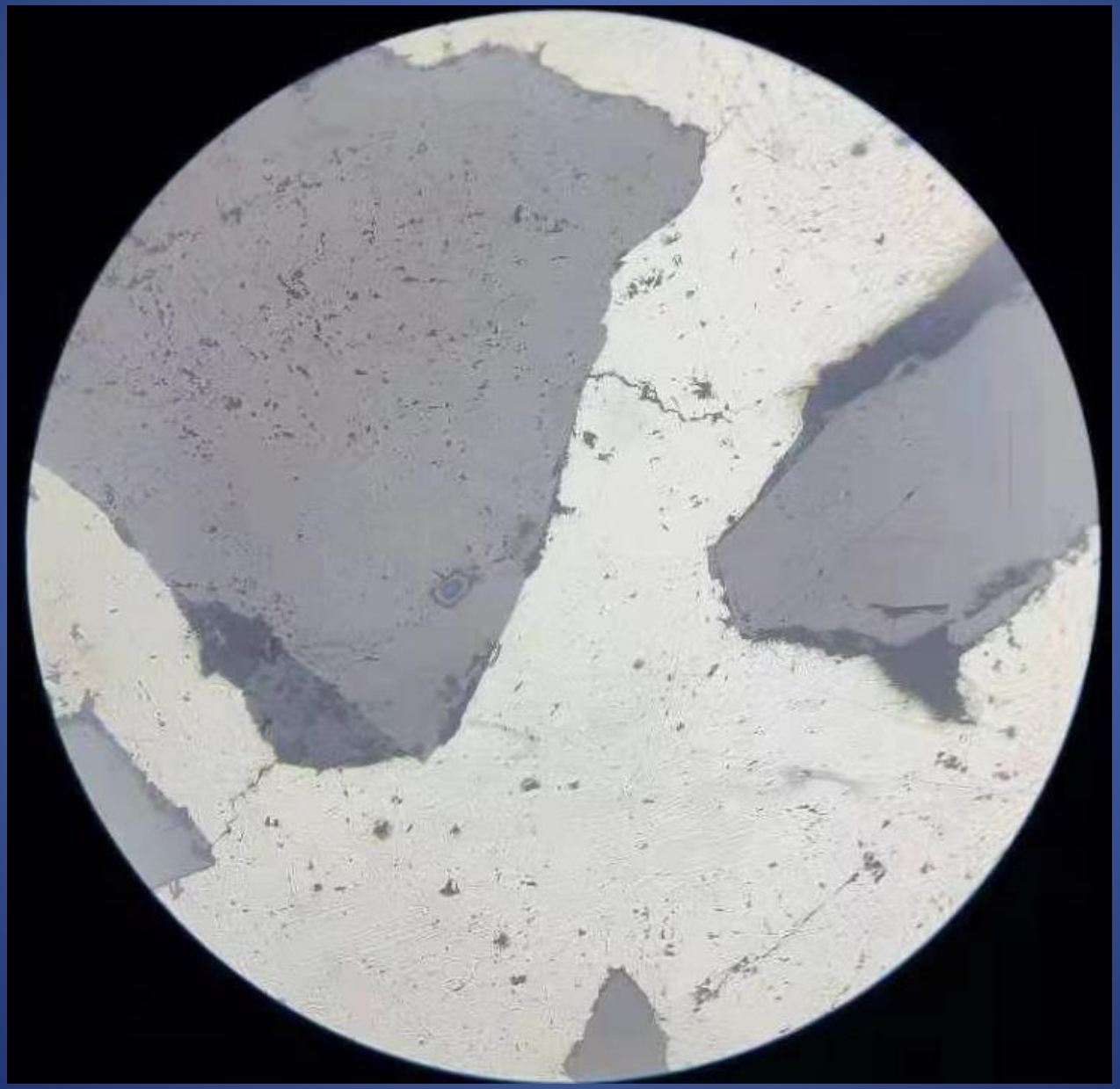


陶瓷（nm）复合高铬铸铁Cr2021机械性能对比
Metallographic of ceramic (nm) composite High Chrome iron Cr2021

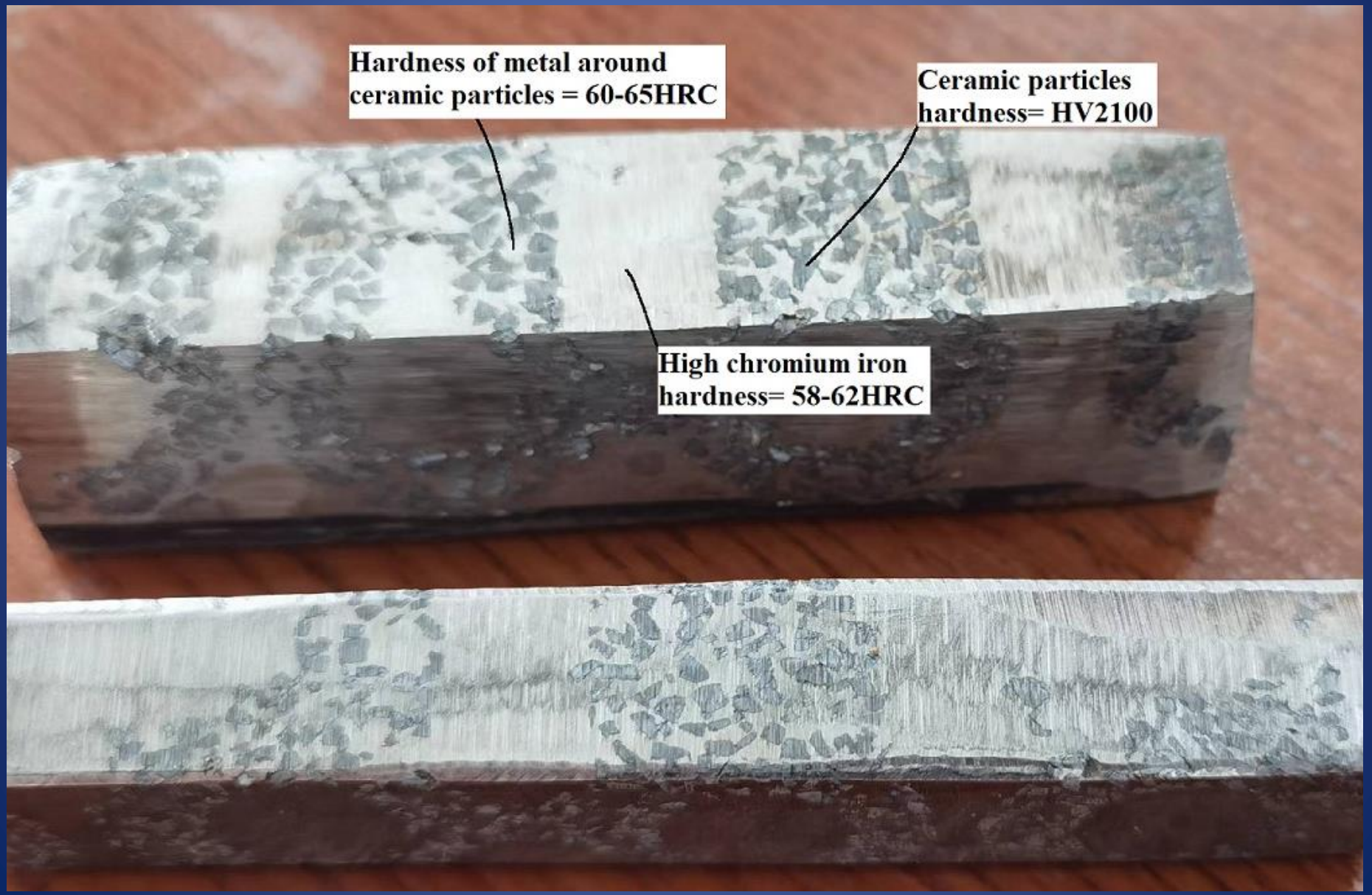


陶瓷与金属界面金相-高铬铸铁Cr2021

Ceramics particle and metal interface metallography of High Chrome iron -Cr2021



高铬铸铁陶瓷复合层硬度
Hardness of ceramic composite layer of High Chrome cast iron- Cr2021



陶瓷（nm）复合铸造立磨辊套/衬板

MMC – Ceramic(nm)composite casting Vertical Grinding Mill Roller/Liner

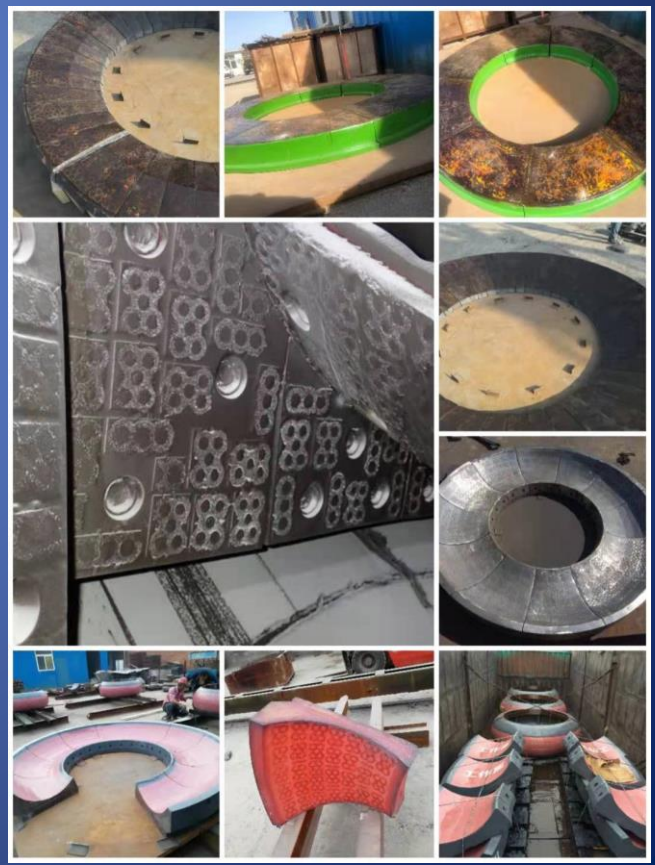
DJM-1# 陶瓷预制体 + DJM-2# Al陶瓷膏+FeCe30（10kg）+ NiY8(8kg)

DJM采用金属陶瓷颗粒为增强相、高铬铸铁为基体金属、利用纳米陶瓷提高金属基体的冲击韧性及强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而***获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击韧性及强度、***使用寿命是传统产品的1-3倍

DJM uses metal ceramic particles as the reinforcing phase and high-chromium cast iron as the matrix metal. It enhances the impact toughness and strength of the metal matrix with nano-ceramics. In the easily worn parts, the reinforcing phase - ceramic particle preforms are cast in. During the casting process, the matrix metal and the alloyed ceramic particles are metallurgically bonded under the high-temperature action of the molten metal***, thereby obtaining a metal matrix ceramic composite layer with a stepped hardness distribution. This significantly improves the wear resistance, impact toughness and strength***, and the service life is 1-3 times that of traditional products.







陶瓷复合立式螺旋搅拌磨机(塔磨机)螺旋衬板

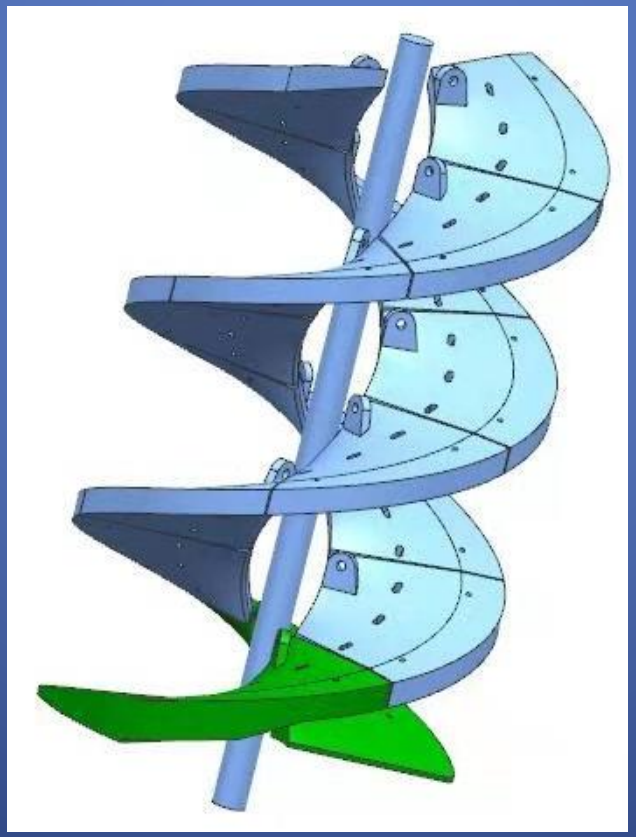
ceramic insert spiral liner of Vertical spiral agitating mill (towermill, VTM)

DJM-1# 陶瓷预制体 + DJM-2# Al陶瓷膏+FeCe30（10kg）+ NiY8(8kg)

DJM采用金属陶瓷颗粒为增强相、高铬铸铁为基体金属、利用纳米陶瓷提高金属基体的冲击韧性及强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而***获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击韧性及强度、***使用寿命是传统产品的1-3倍

DJM uses metal ceramic particles as the reinforcing phase and high-chromium cast iron as the matrix metal. It enhances the impact toughness and strength of the metal matrix with nano-ceramics. In the easily worn parts, the reinforcing phase - ceramic particle preforms are cast in. During the casting process, the matrix metal and the alloyed ceramic particles are metallurgically bonded under the high-temperature action of the molten metal***, thereby obtaining a metal matrix ceramic composite layer with a stepped hardness distribution. This significantly improves the wear resistance, impact toughness and strength***, and the service life is 1-3 times that of traditional products.







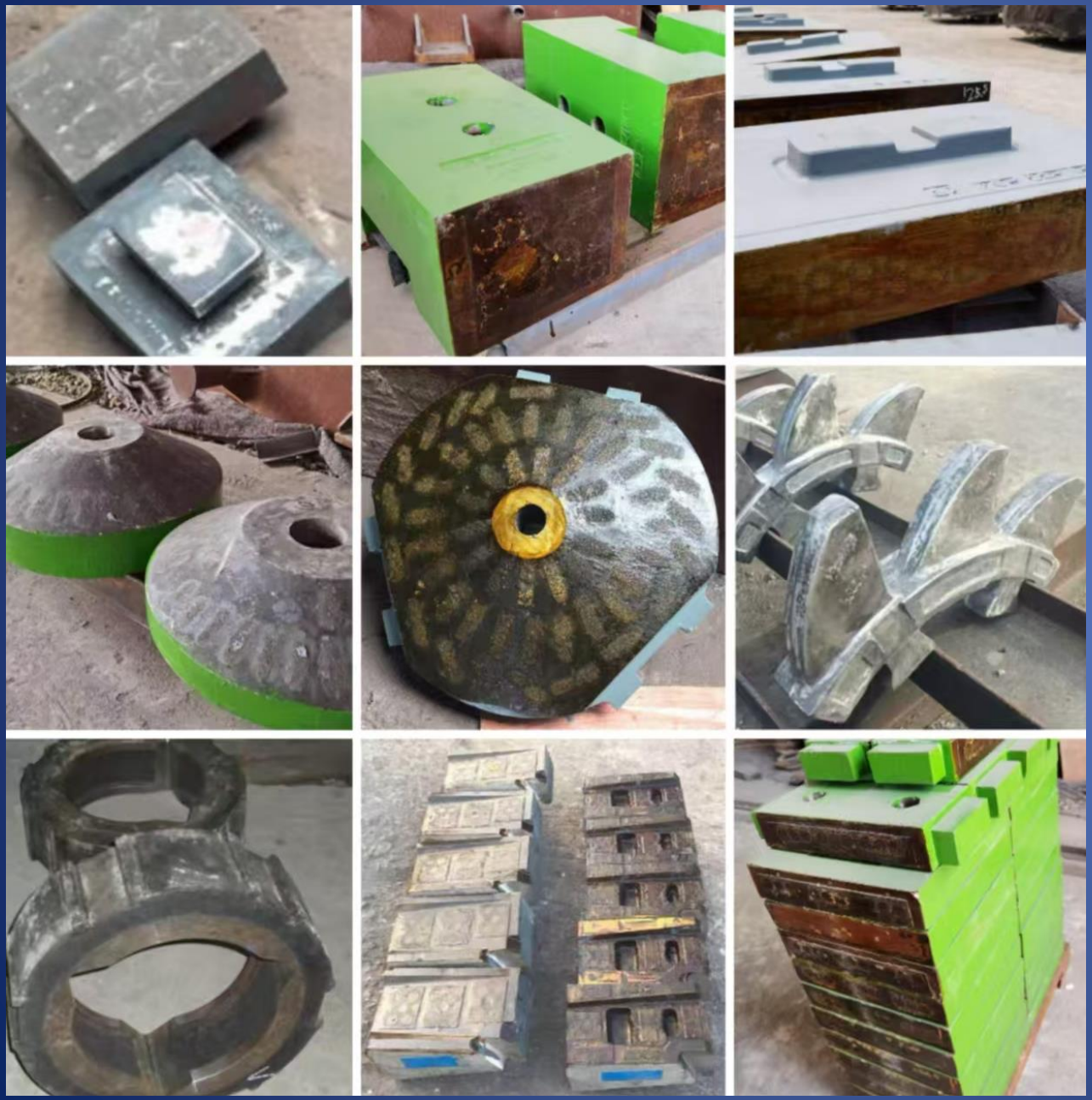
陶瓷复合高铬铸铁反击板/叶轮/护板/粉料锥

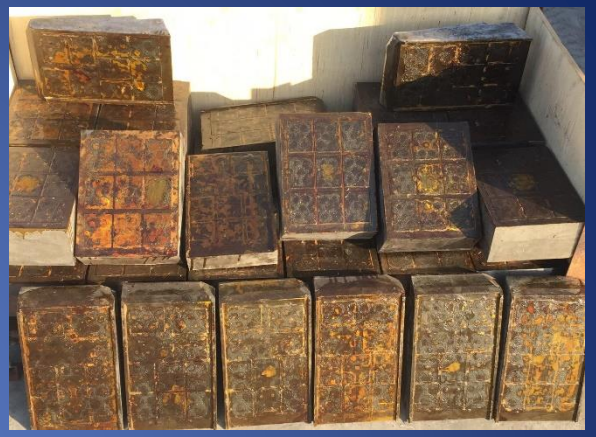
Anvil / Impellers / Impact plates / Liner of ceramic composite High Chrome iron



陶瓷复合高铬铸铁

Wearparts of ceramic composite High Chrome iron







陶瓷复合高铬铸铁衬板

Liner of ceramic composite High Chrome iron











陶瓷复合雷蒙磨-磨辊-磨环-
Ceramic insert Raymond mill-Ring-roller







陶瓷复合雷蒙磨-磨辊-磨环
Ceramic insert Raymond mill-Ring-roller







陶瓷（nm）复合高铬铸铁渣浆泵叶轮/护板/蜗壳
slurry pump impellers/guard plates/volutes of ceramic (nm) composite High Chrome iron

DJM采用金属陶瓷颗粒为增强相、高铬铸铁为基体金属、利用纳米陶瓷提高金属基体的冲击韧性及强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击韧性及强度、使用寿命是传统产品的1-3倍

DJM uses metal ceramic particles as the reinforcing phase and high-chromium cast iron as the matrix metal. It enhances the impact toughness and strength of the metal matrix with nano-ceramics. In the easily worn parts, the reinforcing phase - ceramic particle preforms are cast in. During the casting process, the matrix metal and the alloyed ceramic particles are metallurgically bonded under the high-temperature action of the molten metal, thereby obtaining a metal matrix ceramic composite layer with a stepped hardness distribution. This significantly improves the wear resistance, impact toughness and strength, and the service life is 1-3 times that of traditional products.







陶瓷（nm）复合高铬铸铁渣浆泵叶轮/护板/蜗壳

slurry pump impellers/guard plates/volutes of ceramic (nm) composite High Chrome iron

DJM-1# 陶瓷预制体 + DJM-2# Al陶瓷膏+FeCe30（10kg）+ NiY8(8kg)







纳米陶瓷复合高铬铸铁耐磨件

Wearparts of Nano-ceramic composite High Chrome iron

Cr27Mo1+DJM-2# Al陶瓷膏+FeCe30（10kg）+ NiY8(8kg)











陶瓷复合高铬铸铁混凝土搅拌机刮板、衬板
Concrete Mixer Blade, Paddle, liner of ceramic composite High Chrome iron

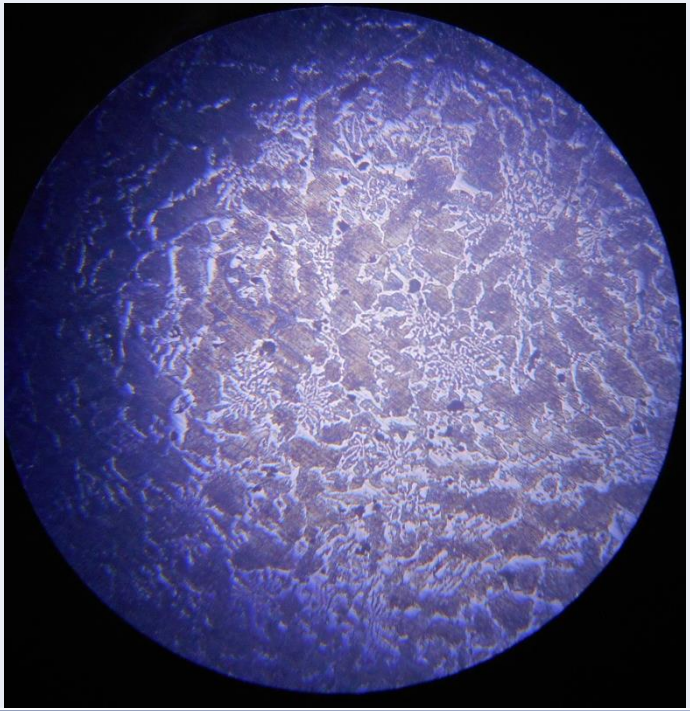
DJM采用金属陶瓷颗粒为增强相、高铬铸铁为基体金属、利用纳米陶瓷提高金属基体的冲击韧性及强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而获得硬度呈阶梯分布的金属基陶瓷复合层，大幅提高耐磨性能、冲击韧性及强度、使用寿命是传统产品的1-3倍

DJM uses metal ceramic particles as the reinforcing phase and high-chromium cast iron as the matrix metal. It enhances the impact toughness and strength of the metal matrix with nano-ceramics. In the easily worn parts, the reinforcing phase - ceramic particle preforms are cast in. During the casting process, the matrix metal and the alloyed ceramic particles are metallurgically bonded under the high-temperature action of the molten metal, thereby obtaining a metal matrix ceramic composite layer with a stepped hardness distribution. This significantly improves the wear resistance, impact toughness and strength, and the service life is 1-3 times that of traditional products.

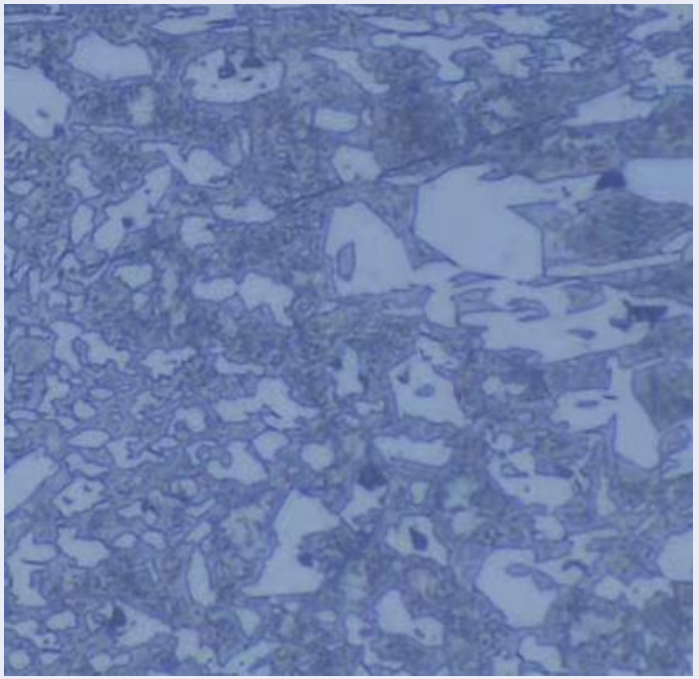


陶瓷复合高铬铸铁Cr2021+Re机械性能对比
Comparison of mechanical properties of ceramic (nm) composite High Chrome iron Cr2021+Re

Cr2021铸态 / 热处理 As-cast Cr2021 / Heat-Treated	使用与渣浆泵叶轮泵壳护板，立轴制砂机抛料头 Impeller, Anvil, Impact Bar, Distributor	Cr2021纳米陶瓷复合铸造 Cr2021 Ceramic Particle Composite casting DJM-2-1# Al陶瓷膏+FeCe30(10kg)+NiY8(8kg)
480-550MPa / 600-650MPa	Tensile Rm： Mpa	643MPa
400Mpa / 500-700Mpa	Yield Re： Mpa	505MPa
1-3J/cm2 / 3-6J/CM2	Impact： Kw2 (KV2)	10-16J/CM2 （5-6J/CM2 KV2）
HRC53 / HRC58	Hardness： HRC	60HRC



C:2.3-2.9
Al：0.2
Ce：0.3
Cr:18-22
Y:<0.06
Mo:0.3
Ni:0.5
Mn：0.8
Si：0.5
S:<0.06
P:<0.10



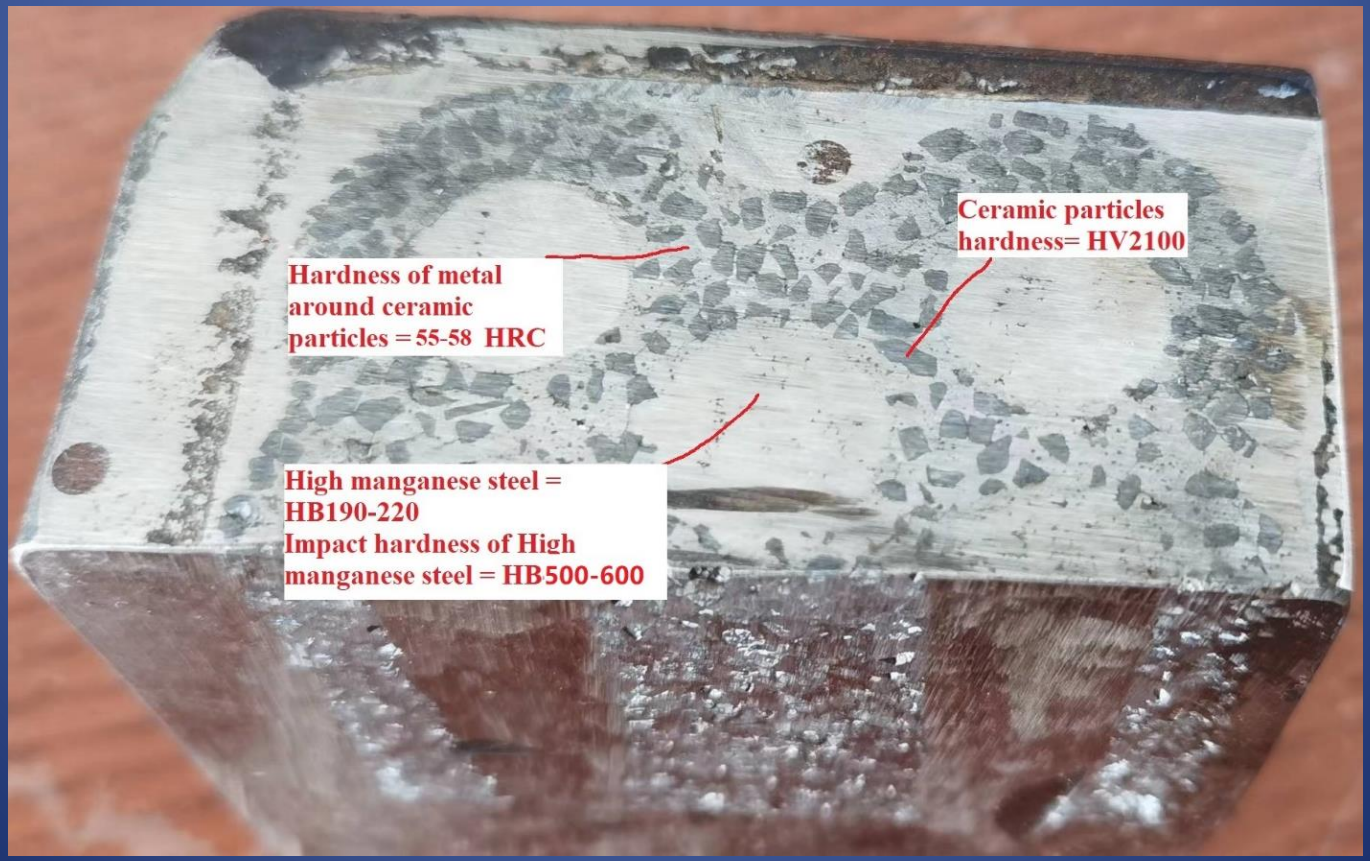
高锰钢陶瓷复合铸造

MMC- High Manganese Steel Ceramic Insert composite casting

DJM-**1-1#** 陶瓷预制体 + DJM-2-1# Al陶瓷膏 + NiY8（0.6kg/ton）+ FeCe30（10kg/ton）

DJM采用金属陶瓷颗粒为增强相、高锰钢为基体金属、利用纳米陶瓷提高金属基体的屈服强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而获得硬度呈阶梯分布的金属基陶瓷复合层，***大幅提高耐磨性能、屈服强度，且塑性变形小，***尤其在高冲击工况下大幅提高耐磨性能、延长使用寿命，使用寿命是传统产品的1-3倍

DJM uses metal ceramic particles as the reinforcing phase and high manganese steel as the matrix metal. It enhances the yield strength of the metal matrix by using nano-ceramics. In the easily worn parts, the reinforcing phase-ceramic particle preform is cast. During the casting process, the matrix metal and the alloyed ceramic particles are metallurgically bonded under the high-temperature action of the molten metal, thereby obtaining a metal matrix ceramic composite layer with a stepped hardness distribution. **This significantly improves the wear resistance, yield strength, and reduces plastic deformation**. Especially under high-impact conditions, the wear resistance is greatly enhanced and the service life is prolonged. The service life is 1 to 3 times that of traditional products.



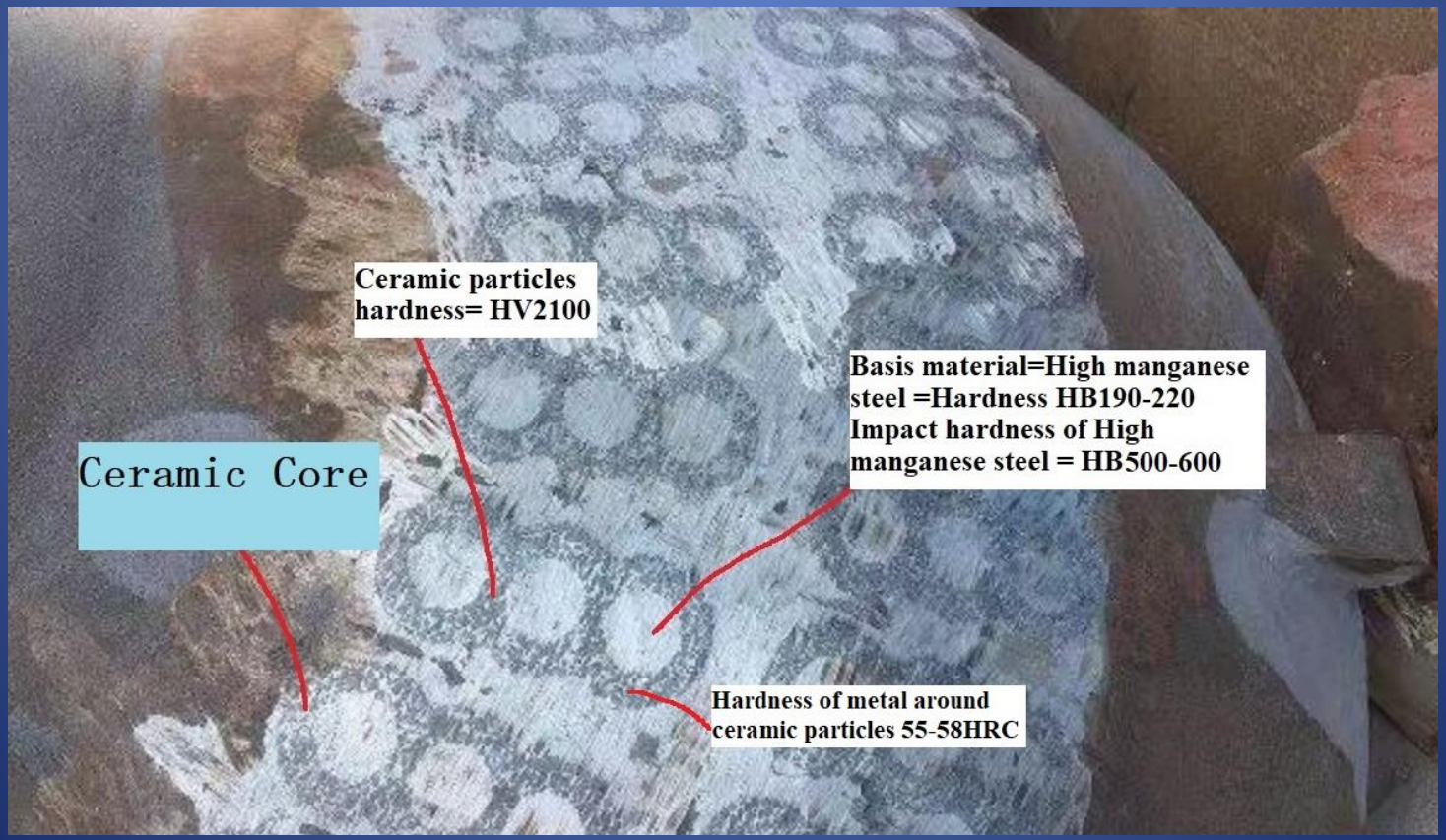
高锰钢陶瓷复合铸造

MMC- High Manganese Steel Ceramic Insert composite casting

DJM-**1-1#** 陶瓷预制体 + DJM-2-1# Al陶瓷膏+ NiY8（0.6kg/ton）+ FeCe30（10kg/ton）

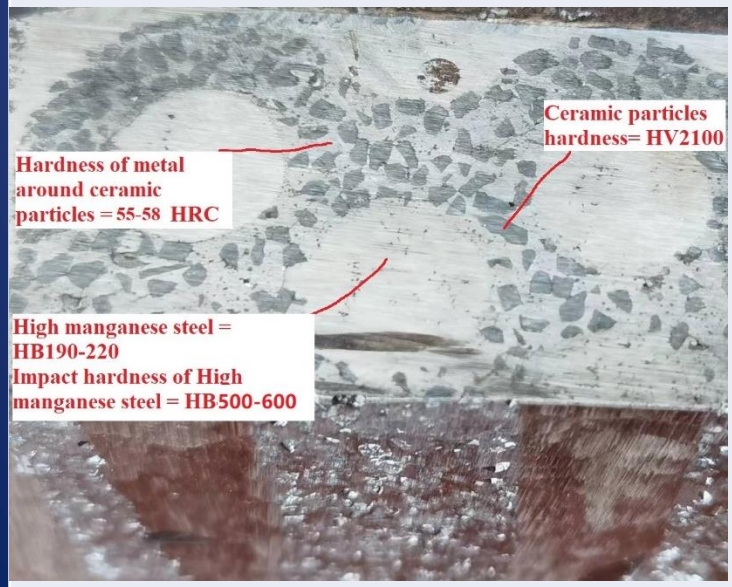
DJM采用金属陶瓷颗粒为增强相、高锰钢为基体金属、利用纳米陶瓷提高金属基体的屈服强度，在易磨损部位熔铸增强相-陶瓷颗粒预制体，熔铸过程中基体金属与合金化后的陶瓷颗粒在金属液高温作用下实现冶金结合、从而获得硬度呈阶梯分布的金属基陶瓷复合层，***大幅提高耐磨性能、屈服强度，且塑性变形小，***尤其在高冲击工况下大幅提高耐磨性能、延长使用寿命，使用寿命是传统产品的1-3倍

DJM uses metal ceramic particles as the reinforcing phase and high manganese steel as the matrix metal. It enhances the yield strength of the metal matrix by using nano-ceramics. In the easily worn parts, the reinforcing phase-ceramic particle preform is cast. During the casting process, the matrix metal and the alloyed ceramic particles are metallurgically bonded under the high-temperature action of the molten metal, thereby obtaining a metal matrix ceramic composite layer with a stepped hardness distribution. **This significantly improves the wear resistance, yield strength, and reduces plastic deformation**. Especially under high-impact conditions, the wear resistance is greatly enhanced and the service life is prolonged. The service life is 1 to 3 times that of traditional products.

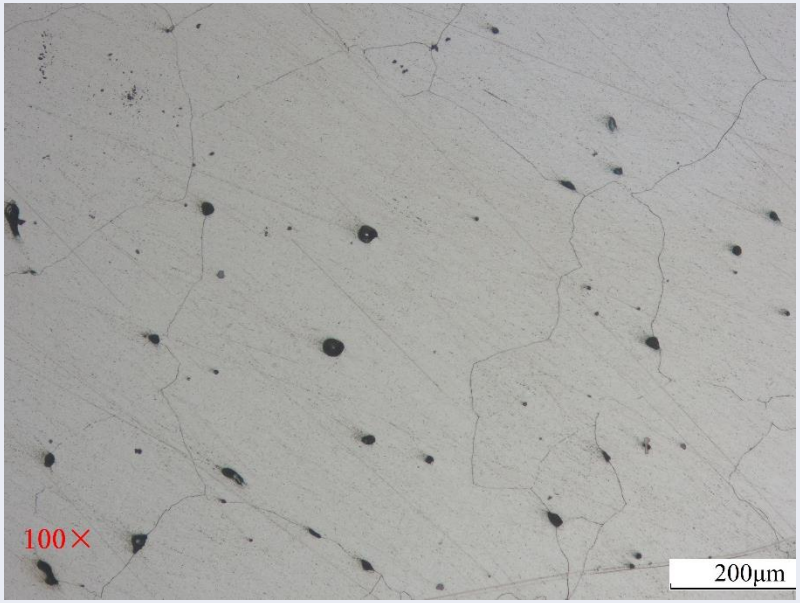


陶瓷（nm）复合高锰钢Mn18Cr2机械性能对比
Comparison of mechanical properties of ceramic (nm) composite High Manganese steel Mn18Cr2

Mn18Cr2 铸造+热处理+回火 Mn18Cr2 Casting+Heat-Treated		Mn18Cr2纳米陶瓷复合铸造+热处理+回火 Mn18Cr2 Ceramic Particle Composite casting DJM-**1-1#** 陶瓷预制体 + DJM-2-1# Al陶瓷膏
650/Mpa	Tensile Rm：Mpa	600Mpa
270/Mpa	Yield Re：Mpa	400Mpa
120J/CM2	Impact ： Akv	110J/CM2
180HB	Hardness：HB	185HB
200HB	350℃ temper Hardness：HB	220HB
400Mpa	350℃ temper Yield Re: Mpa	500Mpa
450HB	Impact Hardness: HB	550HB
	Ceramic layout Hardness	55-58HRC



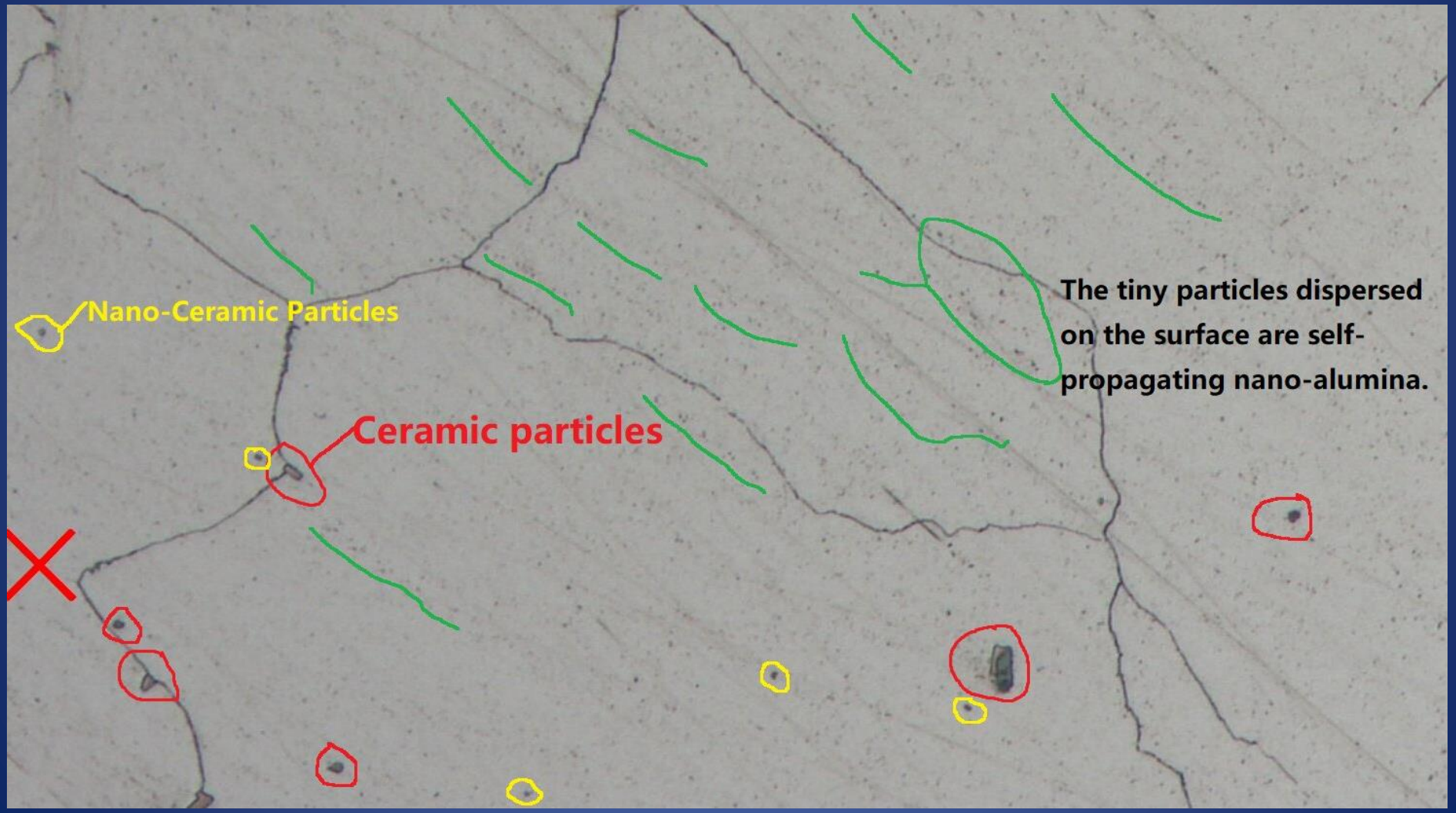
C: 0.9-1.3
Al：0.2
Cr: 2.00-3.00
Mo：0.3
Mn：18-20
Si：0.3-0.6
P：<0.07
S：<0.04
Y：0.02-0.05



陶瓷（nm）复合高锰钢Mn18Cr2金相

Metallographic of ceramic (nm) composite High Manganese steel Mn18Cr2

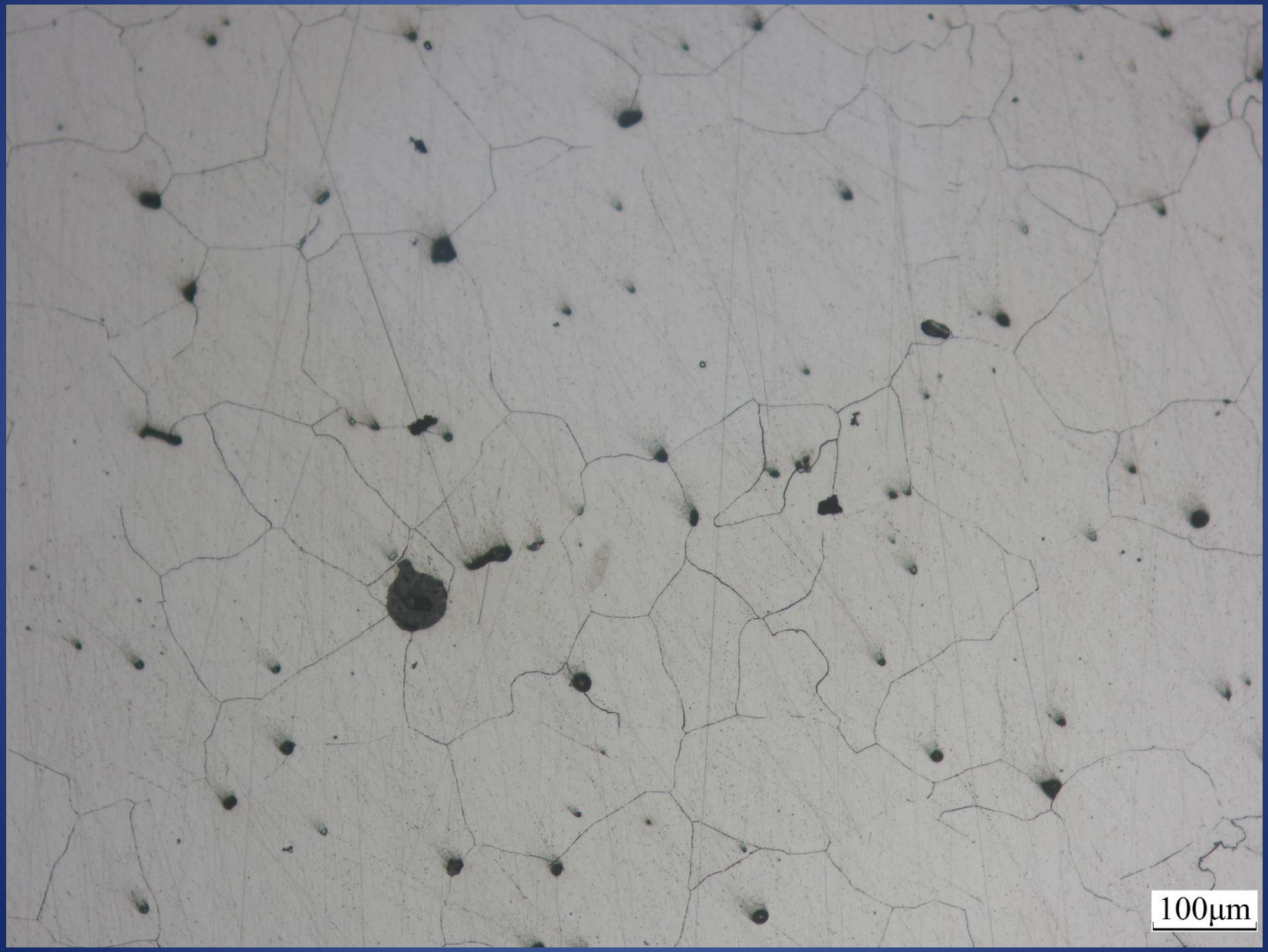
DJM-5# Al陶瓷膏 x500



陶瓷（nm）复合高锰钢Mn18Cr2金相

Metallographic of ceramic (nm) composite High Manganese steel Mn18Cr2

DJM-5# Al陶瓷膏-.1050水韧+350x2h回火



高锰钢陶瓷复合鄂碎齿板

High Manganese Steel Ceramic Insert Composite jaw plate

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高锰钢陶瓷复合破碎壁/扎臼壁

High manganese steel ceramic insert composite Cone/Mantle

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谢谢！
Thanks！

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