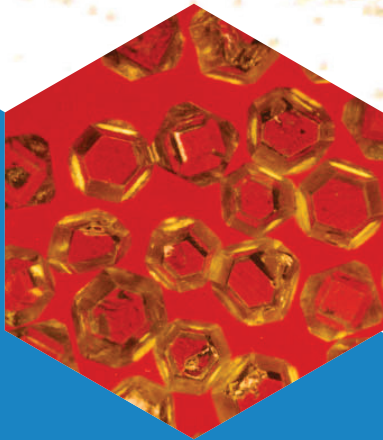


TOOLMAKER SOLUTIONS
MBS[®] Diamonds



Uncoated and coated
diamond mesh abrasives for
demanding applications in
construction and mining

 **HYPERION**
Materials & Technologies

WELCOME TO HYPERION

Hyperion Materials & Technologies is an engineering company with more than six decades of experience in the development and manufacturing of innovative diamonds, cubic boron nitrides, and cemented carbides. In addition to innovative materials, Hyperion offers our extensive knowledge, unique services, and application development capabilities to support our customers' competitive needs.

We are over 1,600 people dedicated to creating solutions for your hard and super-hard material needs through partnership, innovation, and invention. Hyperion's offering includes diamonds for grinding, mining, drilling, sawing, metal and stone cutting, and construction applications.

Hyperion's technical expertise and global manufacturing facilities are a foundation from which a network of local sales and customer service teams support our customers in the development of effective solutions.

FROM START TO FINISH

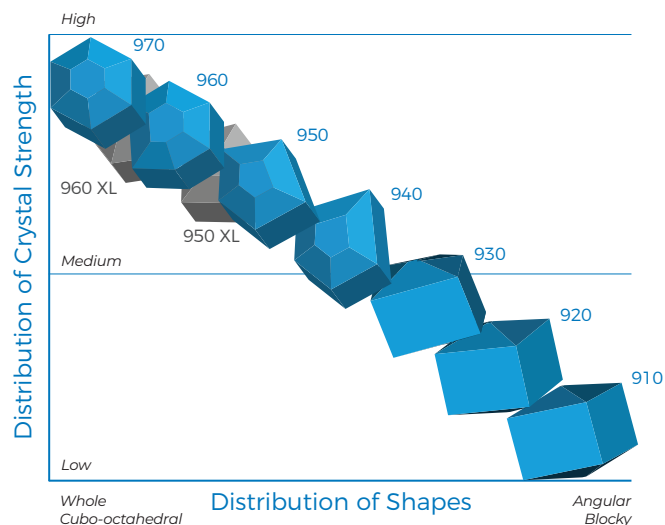
Hyperion's MBS® uncoated synthetic industrial diamonds are created in a single, continuous manufacturing process. Starting with the highest quality of raw materials, Hyperion uses advanced engineering methods to manufacture diamonds with specific characteristics of shape, strength, toughness, and friability. The result is unprecedented consistency and uniformity. Hyperion has taken the next step and developed a comprehensive series of coatings that may also be applied to the MBS diamonds.

CONSISTENCY THROUGH SIX SIGMA QUALITY

Hyperion is committed to focusing on creating solutions for our customers' needs. For manufacturing of our diamonds, we have invested in proprietary Six Sigma controlled processes that bring consistency and repeatability to our diamonds. This allows our customers to save time and money.

PRODUCT DESIGN CONCEPT OF MBS® 900 DIAMOND SERIES

Hyperion's MBS® 900 diamond series is a full line of advanced engineered crystals designed for sawing and drilling applications. Product characteristics of size, shape, impact toughness, fracture strength, and thermal stability have been designed to meet performance requirements for a wide range of sawing and drilling applications in the mining, oil and gas, stone processing, renovation, and construction industries.



THE ART OF DIAMOND CHARACTERIZATION

Hyperion's MBS® 900 diamond series is manufactured under a process of advanced engineering methodology. Hyperion developed revolutionary characterization techniques to achieve the highest product quality and consistency.

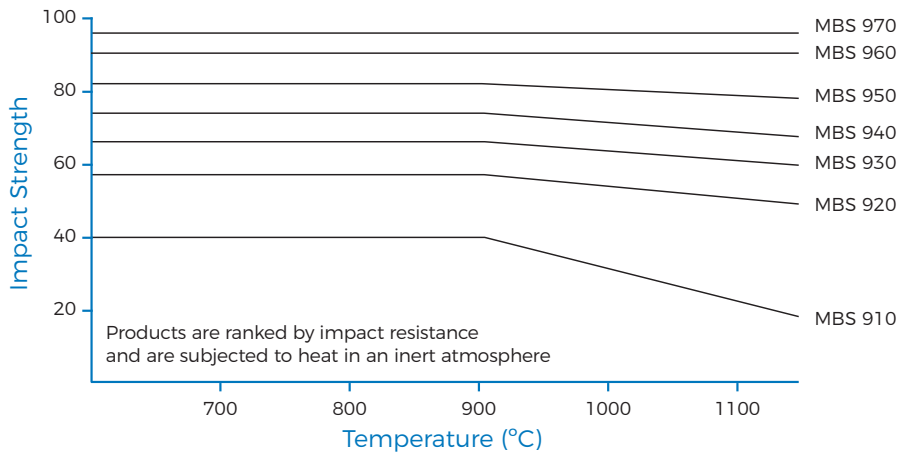
WELL-DEFINED CRYSTAL STRENGTH

Compressive fracture strength (CFS) testing resembles the actual dynamic impact loading a crystal experiences during a cutting process more closely than any other conventional method. It provides a genuine distribution of strengths within a population of diamonds. Hyperion is able to engineer diamonds to maximize the effects of compressive fracture strength.

QUANTIFIABLE SHAPE MEASUREMENT

Hyperion has taken the procedure of visual shape characterization from an art to a science by use of computer image analyses. Eccentricity, a quantifiable measurement of shape, is used as part of an engineering process to create, characterize, and evaluate premium grade MBS diamonds.

IMPACT STRENGTH THERMAL TOUGHNESS RANKING OF MBS 900 DIAMOND SERIES



MBS® 970 DIAMOND - THE TOUGHEST AND MOST THERMALLY STABLE DIAMOND IN THE MARKET

Hyperion's MBS 970 diamond was developed through innovative diamond characterization technology in the fields of optical spectroscopy, image analysis, and fracture mechanics. The superior properties of this diamond enable improved wear performance ranging up to 50% in challenging applications, while power consumption decreases as much as 10%.

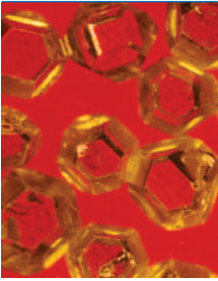
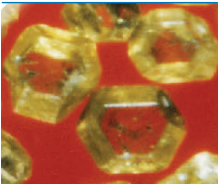
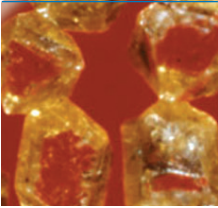
PHYSICAL PROPERTIES

MBS 970 diamond contains engineered crystals with extremely high strength, thermal stability, and controlled shapes.

APPLICATIONS

- Core drilling - Wire sawing - Multi blade and large blade slabbing - High performance sawing and drilling.

MBS® 900 DIAMOND SERIES

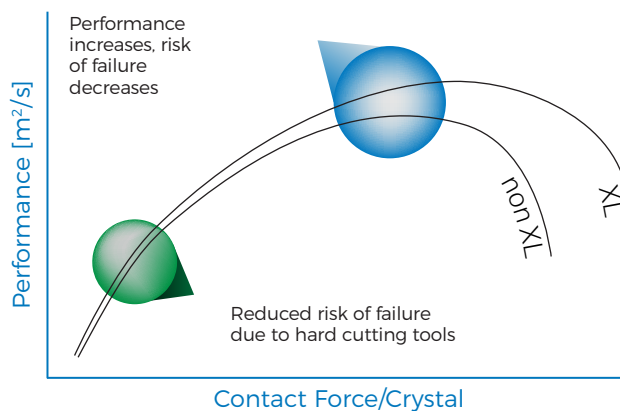
PREMIUM GRADES	PRODUCT	DESCRIPTION	SUITABLE FOR APPLICATIONS DEMANDING:
	MBS 970 Diamond	- Extremely high strength - Supreme thermal stability - Controlled shapes	- Consistent, aggressive penetration and/or cut rates - Superior tool life
	MBS 960 Diamond	- Optimized shape - Minimal inclusion level - High impact strength	- Very high impact and high power applications
	MBS 950 Diamond	- Low inclusions - High thermal strength - Narrow shape distributions	- High impact/power restricted machines
MEDIUM GRADES	PRODUCT	DESCRIPTION	SUITABLE FOR APPLICATIONS DEMANDING:
	MBS 940 Diamond	- Moderate inclusion level - Wider variety of shapes and strengths	- General purpose applications
	MBS 930 Diamond	- Medium friable diamond - Retains high percentage of cutting edges	- Premium diamond for dry cutting blades
ECONOMY GRADES	PRODUCT	DESCRIPTION	SUITABLE FOR APPLICATIONS DEMANDING:
	MBS 920 Diamond	- Moderately friable diamond with a combination of cubo-octahedral crystals and other whole shapes	- Moderate applications where impact strength is favored
	MBS 910 Diamond	- Higher friability - Broader distribution of shape and strength properties	- Light applications where moderate impact strength is required

MBS® XL DIAMONDS

ENHANCED CRYSTAL DESIGN

Hyperion's MBS XL diamonds are the result of an enhanced crystal design of the MBS 900 diamond series for applications where an extremely robust performance is the key to success. The MBS XL diamond crystal design enables higher throughput at lower system costs allowing for the use of enhanced cutting parameters and considerably longer tool life. The MBS XL diamond proprietary design technology significantly reduces the risk of field failures, even under the most adverse conditions.

LOW RISK AND BIG WIN FOR TOOL MANUFACTURERS AND END USERS



MBS® UNCOATED DIAMOND

GENERAL APPLICATION GUIDELINES*

MBS Diamond Grades	Premium Grades					Medium Grades		Economy Grades	
	970	960 XL	960	950 XL	950	940	930	920	910
Reinforced Concrete Hard Aggregate	Flat sawing								
	Wire sawing								
				Wall sawing					
Concrete Most Aggregates				Flat sawing					
				Wire sawing				Block grinding	
				Core drilling					
	Highway drilling						Hand-held sawing, DIY		
Green Concrete and Asphalt	Flat sawing								
Granite	Wire sawing								
	Large blade sawing								
	Multi-blade sawing								
	Trimming					Calibrating		Polishing	
						Wire sawing			
Marble Limestone						Frame sawing			
						Trimming			
						Calibrating			

MBS Premium Diamond Grades	970	960 XL
Exploratory Mining	Core sample removal	
Oil & Gas Mining	Impregnated downhole drilling	

* These are general guidelines. Please consult with your local sales representative for specific application requirements.

MESH SIZE / FEPA SIZES AVAILABLE

	SINGLE SIZES									COMBINED SIZES*							
	20/25 (D851)	25/30 (D711)	30/35 (D601)	35/40 (D501)	40/45 (D426)	45/50 (D356)	50/60 (D301)	60/70 (D251)	70/80 (D213)	20/30 (D852)	25/35 (D712)	30/40 (D602)	35/45 (D502)	40/50 (D427)	45/60 (D357)	50/70 (D302)	60/80 (D252)
MBS 970 Diamond	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MBS 960 XL Diamond	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
MBS 950 XL Diamond		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
MBS 960 - 910 Diamonds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

* All combined size ranges are held to ± 5% tolerance of single size composition.
For 18/20 mesh size availability, please contact Hyperion.

MBS® DIAMOND COATINGS

Hyperion Materials & Technologies, through our extensive research and development capabilities, has developed the most comprehensive series of diamond coatings available in today's market. Coatings protect the diamond crystal from aggressive bonding metals such as iron, steel, chromium, and tungsten.

Hyperion's coatings are based on titanium, chromium, silicon, copper, silver, and nickel. Each coating is formulated to offer a solution for a specific application, from sawing and drilling to cutting and polishing.

Toolmakers utilizing coated MBS products enjoy a new flexibility in manufacturing innovative, highly economical bond systems. Unmatched free cutting properties, reduced diamond pull-outs, and maximum utilization of every cutting crystal in the bond matrix are key quality factors for success in a highly competitive market.

End users in the stone and construction business benefit from higher cutting parameters while still experiencing longer tool life. Less power consumption is a direct benefit from the superior free cutting capabilities of tools with coated MBS diamonds.

Straighter cuts, cleaner drilling holes, as well as reduced edge chipping also help to achieve an overall cost optimization. The result is high quality work that will satisfy even the most demanding customer.

Our titanium based coating (Ti1) has been specifically developed for diamond grades MBS 950 and below. With Ti1, Hyperion expands its highly successful coatings series for the medium and economy grade crystals.

BENEFITS FOR THE TOOLMAKER

- Enhanced flexibility in manufacturing
- Reduced diamond pull-outs from bond matrix
- Maximum utilization of cutting crystals
- Improved free cutting properties.

BENEFITS FOR THE END USER

- Higher cutting parameters
- Straighter cuts and better cutting edges
- Lower power consumption
- Longer tool life
- Process cost optimization.



MBS® COATED DIAMONDS - GENERAL BOND RECOMMENDATIONS FOR SUPERIOR PERFORMANCE

The use of coated MBS diamond products requires an evaluation of the compatibility with the bond system and manufacturing conditions.

COATING	BOND	TYPICAL APPLICATIONS
Ti1 - Titanium Based	<ul style="list-style-type: none"> - Nearly all common bonds - Restrictions when oxygen content is high and in highly reactive/high temperature bonds 	<ul style="list-style-type: none"> - Essentially in all medium to light duty stone and construction applications
Ti2 - Titanium Based	<ul style="list-style-type: none"> - Nearly all common bonds - Restrictions when oxygen content is high and in high molybdenum content bonds 	<ul style="list-style-type: none"> - Essentially in all stone and construction applications
Cr2 - Chromium Based	<ul style="list-style-type: none"> - Nearly all common bonds - Can be helpful when oxygen content is high or poorly controlled. Works well in bonds with cobalt > 1 µm - Use with caution in high (> 20%) bronze and iron bonds and bonds with copper > 10% 	<ul style="list-style-type: none"> - Essentially in all demanding stone and construction applications
Si2 - Silicon Based	<ul style="list-style-type: none"> - Chemically reactive (i.e., bonds containing Fe) at temperatures of 800°C and higher 	<ul style="list-style-type: none"> - Construction tools - Stone: saws, drills, wires
MBS SB Super-Spiked	<ul style="list-style-type: none"> - Copper alloy, Cobalt, and bronze - No atmosphere control required; temperatures less than 900°C 	<ul style="list-style-type: none"> - Core drills, wall saws, circular marble saws, stone trimming blades



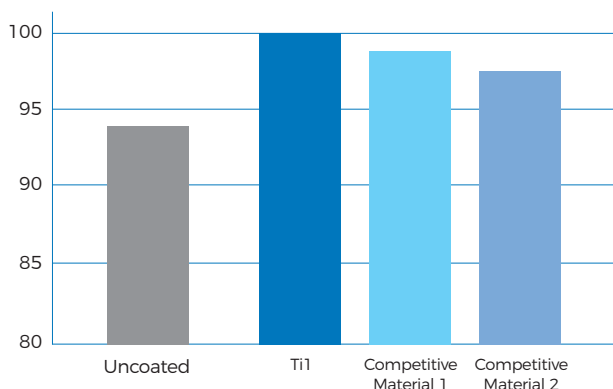
MBS® Ti1 COATED DIAMONDS - ROBUST COATING FOR MEDIUM AND ECONOMY GRADES

EXPANDING THE SUCCESS

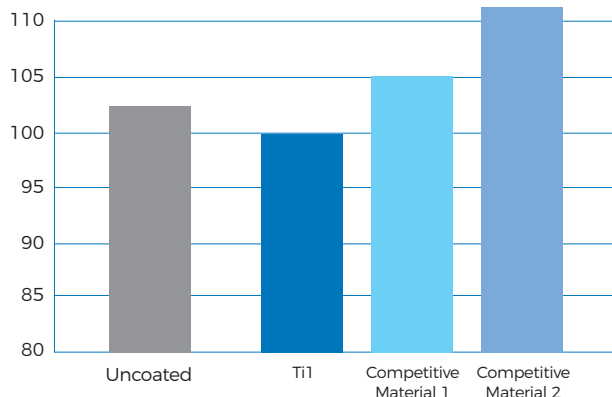
Hyperion Materials & Technologies developed a proprietary coating technology to apply a robust titanium carbide coating to medium and economy grade MBS diamond crystals. Our product philosophy is that high quality means optimum performance through the selection of the diamond grade best suited for a given application. Expanding our coating technology into medium and economy grades is an essential part of this concept. The successful performance of MBS coated diamonds in heavy duty applications caused an increasing demand from customers to offer this technology and its benefits throughout all grades of the MBS diamond family.

The coating design of Ti1 enables toolmakers to adjust their bonding systems smoothly to the new coated diamonds. Ti1 coating protects the crystal effectively from aggressive bond materials such as iron, steel, chromium, and tungsten. Enhanced bond retention, high crystal protrusion, and excellent free cutting capabilities are additional benefits. The outstanding mechanical toughness of this coating allows the use of diamonds even in the more demanding stone and construction applications.

WEAR PERFORMANCE FIELD TEST TRIMMING OF CLASS II GRANITE



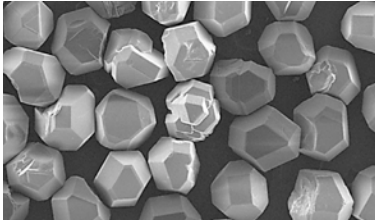
POWER CONSUMPTION FIELD TEST TRIMMING OF CLASS II GRANITE



For tools with approximately the same wear performance, Ti1 coated diamonds deliver the best free cutting capability available.



MBS® Ti1 COATED DIAMONDS



Ti1 coating offers effective crystal protection from aggressive bond materials, enhanced bond retention, high crystal protrusion, and excellent free cutting capabilities.

GENERAL APPLICATION GUIDELINES*

MBS Diamond Grades	950	945	940	935	930	925	920	915	910
	Medium Impact			Low Impact			Very Low Impact		
Concrete Asphalt	Non-reinforced			Hand-held equipment			Hand-held equipment		
	Medium aggregates						Do-it-yourself cutters		
	Light aggregates								
Granite	Trimming			Polishing					
	Calibrating								
Marble Limestone Soft Stone							Wire sawing		
							Frame sawing		
							Polishing		
Hard Marble Limestone	Wire sawing								
	Frame sawing								
	Trimming								
	Calibrating								
Soft Marble Limestone				Wire sawing					
				Frame sawing					
				Trimming					
Natural Diamond Replacement									

* These are general guidelines. Please consult with your local sales representative for specific application requirements.



MBS® Ti2 COATED DIAMOND AND MBS Cr2 COATED DIAMOND FOR SAWING AND DRILLING IN GRANITE AND REINFORCED CONCRETE

WHEN THE GOING GETS TOUGH - THE TOUGH GET GOING

Hyperion Materials & Technologies' MBS Ti2 coated diamond and MBS Cr2 coated diamond established new standards in diamond tool manufacturing as well as field results. In demanding applications, such as hard granites and reinforced concrete. Hyperion's MBS Ti2 and Cr2 coated diamonds are superior to any other product on the market.

GENERAL APPLICATION GUIDELINES FOR MBS Ti2 AND MBS Cr2 COATED DIAMOND

MBS Diamond Grades	970	960	955	950
	Very High Impact High Power Machine High Cutting Rates	High Impact Power Restricted Machine		
Concrete Asphalt	Reinforced	Reinforced		
	Tough aggregates	All aggregates		
Granite	Wire sawing	Wire sawing		
	Multi-blade slabbing	Multi-blade slabbing		
	Large blade slabbing	Large blade slabbing		
	Trimming	Trimming		
Marble / Limestone	Belt sawing			
Exploration / Mining	Core drilling			

FIELD TEST OF GRANITE TILE CUTTING WITH MULTIBLADES

TEST CONDITIONS

Diamond	MBS Ti2 coated diamond
Material	Granite class IV - V (Scale I -V)
Machine	Pedrini M 595 VJ-78/HN/SN "Arc de Triomple"
Saw Blades	80 blades on 1 spindle with a 1000 mm outside diameter
Traverse Rate	17 m/min
Depth of Cut	0.8 mm upcut and downcut
Quantity of Cut	240 - 260 m ² per diamond blade

Improved tool life of 20%

FIELD TEST OF CURED CONCRETE CUTTING

TEST CONDITIONS

Diamond	MBS Cr2 coated diamond
Material	Cured concrete
Machine	15 kW, 20 PS
Saw Blades	350 mm outside diameter
Depth of Cut	6 mm

Improved tool life of 138%



MBS® Si2 COATED DIAMONDS – CLEAR THE WAY FOR HIGH CONTENT IRON BONDS

SUBSTANTIAL REDUCTION IN BOND RAW MATERIAL COST FINALLY POSSIBLE

Through an innovative proprietary coating process, silicon carbide coated MBS Si2 coated diamonds from Hyperion Materials & Technologies make long awaited improvements in bond raw material cost possible. Toolmakers are now able to reduce their costs significantly by replacing more cobalt with iron in their bonding systems. A replacement of 70% of expensive cobalt powders with lower cost iron powders is feasible by utilizing Hyperion's Si2 coating in the bond matrix.

BEST BET IN ALL ATMOSPHERIC CONDITIONS

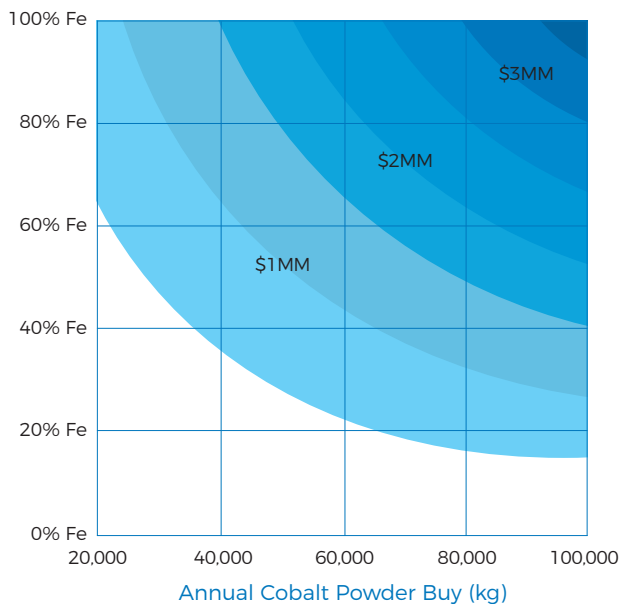
Past attempts to use non-cobalt or low cobalt bonds with high iron content were primarily constrained by the high reaction rates of diamond with iron. Now Si2 coatings greatly enhance diamond crystal retention in high iron bonds. The Si2 coating is strongly bonded, achieving a powerful adhesion to the diamond surface.

MBS Si2 diamonds allow easier sintering control and improved bond flexibility. When manufacturing harder bonds, higher temperatures become necessary. Si2 coating effectively protects the diamond crystal from destructive high temperature reactions. If a non-oxidizing atmosphere is used in the sintering process, bonds with high iron content can also be processed with much higher temperatures without significant loss of diamond grade.

UNMATCHED BOND RETENTION

By adhesion with the high iron bond matrix, unmatched bond retention is reached. The result significantly reduces pullout rates and enhances free cutting properties, even in demanding applications. Every crystal may now be used to its full working potential, thus prolonging tool life and delivering high productivity rates.

ESTIMATED POTENTIAL METAL BOND POWDER COST SAVING (\$MM)



Convincing example: If a toolmaker purchases 60,000 kg of cobalt powder per year, the replacement of 70% of cobalt with iron could result in an annual savings of nearly \$2MM (based on 2019 pricing).

Advantages of MBS Si2 Coated Diamonds

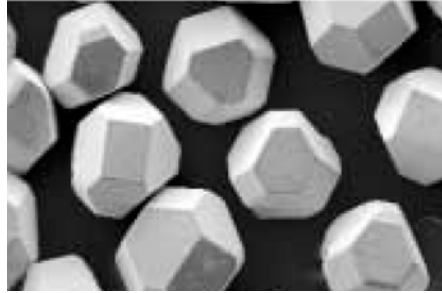
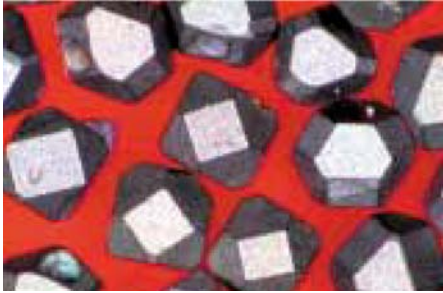
Enhanced

Protection Retention

Lower Costs Higher Performance

MBS Si2 OFFERS SIGNIFICANT COST SAVINGS FOR TOOLMAKERS.

HIGH IRON BONDS AND HIGH SINTERING TEMPERATURES IN NON-OXIDIZING ATMOSPHERES – MBS® Si₂ COATED DIAMONDS CAN TAKE IT ALL





MBS Si₂ Coated Diamonds
Maximum crystal protection for improved bond flexibility and easier sintering control

IRON SEGMENT FRACTURE SURFACE TEST

PROCESSING CONDITIONS

Bond	100% iron
Sintering Temperature	1100°C
Time	10 min
Atmosphere	Argon



CRYSTALS IN IRON SEGMENT

MBS Uncoated Diamond	MBS Si ₂ Coated Diamond
	
Severe reaction – no chemical attachment to bond	No reaction – MBS Si ₂ coated diamond shows good attachment to bond

CRYSTALS RECOVERED FROM IRON SEGMENT

MBS Uncoated Diamond	MBS Si ₂ Coated Diamond
	
Severe reaction – complete loss of crystal edges, corners, and faces	MBS Si ₂ coated diamond resists chemical attack even in 100% iron bond

CRYSTAL PROTECTION IN HIGH IRON BONDS FOR DRY CONCRETE CUTTING

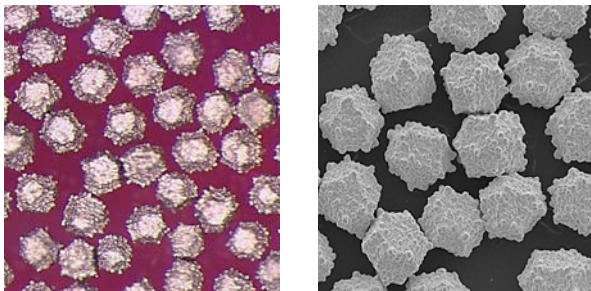
MBS Si ₂ Coated Diamond	MBS Si ₂ Coated Diamond
	
Processed at 970°C	Processed at 1050°C

MBS® SB COATED DIAMOND - ADVANCED SUPER-SPIKED COATING FOR FREE CUTTING SOFT BOND MATRIXES

Through advanced coating design and Six Sigma production technology, Hyperion created our unique super-spiked Soft Bond (SB) Coating. SB Coating was engineered for soft metal bond matrices. SB coating makes the two primary failure modes, poor diamond retention and bond erosion, a thing of the past. Highly desired free cutting capabilities of stone or concrete cutting tools are most effectively achieved through soft bonds, containing a high percentage of copper or copper alloys. Poor adhesion between diamond crystals and the soft metal matrix along with bond erosion are common challenges experienced in this field. The new MBS SB coated diamond addresses these failure modes through an innovative dual coating design.

NEW PRODUCTIVITY HIGHS FOR SOFT BOND TOOL APPLICATIONS

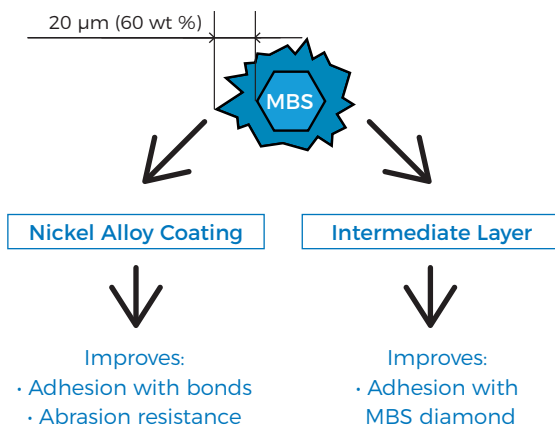
SB Coating is a dual coating engineered specifically for soft metal bonds containing a high percentage of copper or copper alloys. The premium MBS diamond crystal is first protected by an intermediate layer that firmly enhances the chemical adhesion between the diamond and coating. The super-spiked nickel alloy coating achieves the most powerful retention in soft bonds. Mechanical interlocking coupled with chemical interaction at the coating/bond interface minimizes diamond pull-out. This major increase in retention allows maximum utilization of the diamond and provides significantly longer tool life, lower power consumption, and superior cutting edge quality. Applications with lower powered machines, such as wall saws, can benefit greatly from this unique coating. New productivity highs can be achieved in applications where edge quality is critical, i.e., trimming of marble, granite, and ceramic tiles. These improvements make MBS SB coated diamond a cost and performance competitive alternative in a demanding manufacturing environment.



MBS SB coated diamond for soft bond matrices.
Coating level: 60 wt %
Coating thickness: 20 μm

INNOVATIVE DUAL COATING DESIGN OF MBS SB COATED DIAMOND

Intermediate layer plus super-spikes prevent bond erosion and create enhanced crystal retention.



MBS® COATED DIAMONDS

MESH SIZE / FEPA SIZES AVAILABLE

	SINGLE SIZES								COMBINED SIZES*							
	US Mesh (FEPA)	25/30 (D711)	30/35 (D601)	35/40 (D501)	40/45 (D426)	45/50 (D356)	50/60 (D301)	60/70 (D251)	70/80 (D213)	25/35 (D712)	30/40 (D602)	35/45 (D502)	40/50 (D427)	45/60 (D357)	50/70 (D302)	60/80 (D252)
Ti1																
950 940 930	✓	✓	✓								✓	✓	✓			
920 910	✓	✓	✓								✓	✓	✓			
Ti1																
960 XL										✓	✓	✓				
950 XL										✓	✓	✓				
Ti2 & Cr2																
970 960	✓	✓	✓								✓	✓	✓			
950	✓	✓	✓								✓	✓	✓			
Ti2 & Cr2																
960 XL										✓	✓	✓				
950 XL										✓	✓	✓				
Si2																
970 960 950	✓	✓	✓								✓	✓	✓			
940 930	✓	✓	✓								✓	✓	✓			
920 910	✓	✓	✓								✓	✓	✓			
Si2																
960 XL										✓	✓	✓				
950 XL 940 XL										✓	✓	✓				
SB Super-Spiked																
950 XL										✓						
940 XL												✓				
950 XL 960 XL												✓				
950 960						✓										

* All combined size ranges are held to ± 5% tolerance of single size composition.
 Other Mesh/FEPA sizes can be available upon request.
 Tool makers should account for base diamond weight, not merely coated diamond weight in segment preparation.
 Hyperion's quality systems have received ISO 9001:2015 certification.
 Order Specifications: Please specify coated products when ordering; i.e., MBS 940 Ti1 diamond 40/50

