High performance composite *wear*plates and *lite*plates

Hardcarb® composite wearplates

The most reliable and cost-effective solution for protecting large surface areas subject to severe Industrial wear.

Hardcarb® composite wearplates have been developed after decades of practical wear-related experience in various Industries. The technology, perfected by Hardcarb over two decades, employs a proprietary ***Carb-O-inject™*** process which allows rapid deposition of rich wear-resistant overlays on a backing steel plate with extremely low dilution levels (not possible in conventional hardfacing procedures) such that primary carbides are formed directly in the first layer of deposit.

Hardcarb® composite *wear*plates

These include Cr, Nb, B, V bearing overlays, amongst others. They have been engineered to withstand the demands of high impact - abrasion - erosion conditions found in various metal-to-earth applications that may also be accompanied by high temperatures and/or corrosion. Powerful high density tungsten carbide and nanostructured superalloys for extreme wear environments also form a part of this alloy portfolio. Overlay thicknesses can range from 2mm to 30mm on any weldable steel base.

Hardcarb® composite *lite*plates

These are same as Hardcarb® composite wearplates but in a thin format. Overlay thicknesses of 0.5mm, 1mm and 2mm form part of this portfolio. As the manufacturing process is unique and expensive, usually these overlays utilize superalloys providing unparalleled wear resistance in spite of their low thicknesses.

Introduction message from the Chairman

Dr. Rohit Shah
Chairman &
Managing Director

The Company was formed in 1999 as a joint venture with a leading German company to manufacture composite wearplates in India. In 2018, the Indian group completed 100% acquisition of shareholding to become fully independent and having access to global markets.

Hardcarb produces more than 30 different grades of composite wearplates to suit every application and budget. Customized grades are also available for specific requirements.

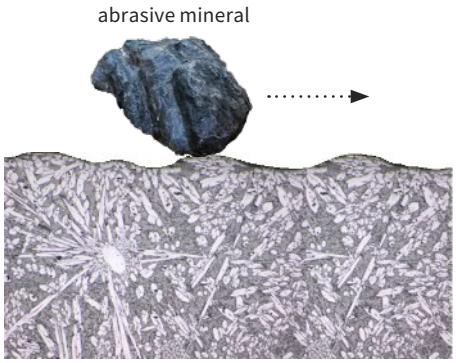
Hardcarb® Composite Wearplates: Minimizing equipment downtime and increasing plant longevity since two decades.

For two decades, Hardcarb Technologies has been in the business of combatting all forms of industrial wear. With an exhaustive range of solutions ranging from composite wear plates - deposition welding materials - hybrid castings - sintered hard materials to welding automation, the company is ideally suited to solve any wear challenge faced by our customers.

Since inception, one of the core products of Hardcarb has been composite wear plates which are today manufactured using a proprietary *Carb-O-inject™* process. This is, still today, one of the few rare techniques of obtaining very hard, dense, primary carbides from top to bottom of the hardfacing deposit. It is this unique property that ensures the superior performance of Hardcarb wearplates as compared to all competitors worldwide.

The hard overlay usually contains a carefully selected combination of hard phases and matrix depending on the application conditions and expected lifetimes.

The idea is to have an engineering material that is harder than the abrasive minerals coming in contact with it during operation; while retaining the workability similar to structural steels. An overlay containing closely packed hard-phases embedded in a relatively ductile matrix is the key to success of such materials. Minerals coming in contact with the overlay will be softer than the hard-phases and are unable to "scratch" or "wear" the overlay, thus prolonging the service life.



Microstructure of the hard overlay shows distinct hard phases which could be carbides, borides or boro-carbides of chromium, niobium, vanadium, titanium, tungsten etc. Presence of these hard elements is essential for reducing wear-rates.

Hardcarb *Carb-O-inject™* process: salient features

Hardcarb composite *wear*plates are manufactured using a proprietary Carb-O-inject™ process where ferro-alloys and carbides are directly injected into the molten weld pool for a rapid quenching effect. This promotes formation of carbide-rich hard overlays with low dilution and penetration. The technology allows easy customizations and overalloying without any practical constaints (such as powder:wire filling ratio in cored wires) to achieve superior properties within the first layer of deposit.

A variation of the technology is to use cored wire plus external injection for creating powerful alloys and superalloys economically.

High quality raw materials, computerized manufacturing equipment, bespoke process and highly experienced team ensure that all Hardcarb wearplates are of consistent world-class quality. With more than 30 grades to suit all kinds of severe wear environments, we are ready for any wear challenge.

Successful and reliable since two decades

Hardcarb wearplates have been produced successfully in India since 1999. Initially only few types of chromium carbide and complex carbide grades were produced under technical collaboration with a leading German Company. Over the years, the alloys and manufacturing process have been vastly upgraded to cover a wide range of applications and difficult wear scenarios.

Balanced energy input ensures reduced dilution and homogenous microstructure

The biggest disadvantage of conventionally produced wearplates (submerged arc, cored wires etc.) is high dilution with the backing base material of the wearplate. Due to the rapid quenching of molten weld pool in Carb-O-inject process, energy input and subsequently dilution levels are very low. This ensures consistent hardness across the thickness and a microstructure that is homogenous and rich in primary carbides from top to bottom of the deposit.

30+ alloy grades in varying thicknesses for every wear condition.

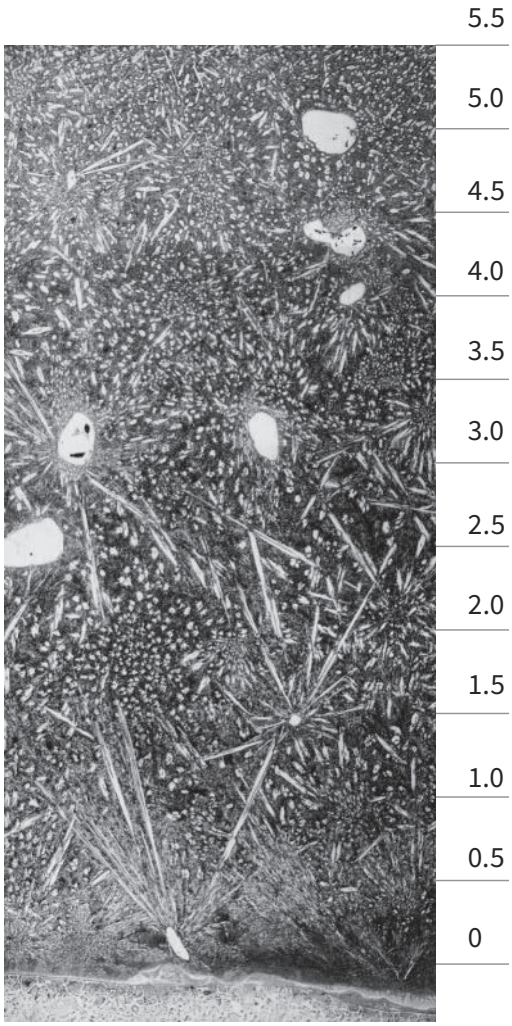
Hardcarb manufactures the widest range of wearplates globally. With more than 30 grades ranging from chrome carbides, complex carbides, tungsten carbides, metal borides and nanostructured materials, there is an answer for every wear challenge posed to us. Overlay thicknesses ranging from 0.5mm upto 50mm are achievable using sophisticated manufacturing procedures, although the most common are 3mm upto 12mm.

Metallurgical advantage.

All Hardcarb wearplates come with high quality ingredients and know-how in the overlay which impart high carbide hardness, toughness and grain refinement along with strong bond strength and cold forming capabilities. A 5+3 wearplate can be easily rolled to a diameter a low as 250 mm when hardfacing is inside and 350mm with outside hardfacing.

More carbides = Higher Lifetime

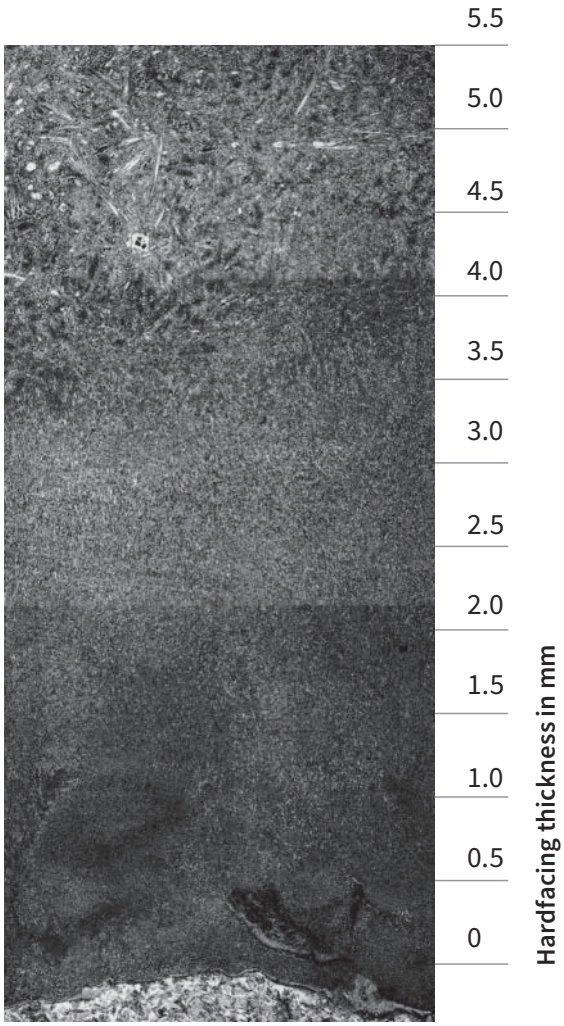
The unique *Carb-o-inject™* process ensures low dilution as well as extra low penetration of temperature and high alloyed powder.



Wearplate made using Hardcarb Carb-O-inject technology

Structure of a Hardcarb composite wearplate with one layer of hardfacing by means of the proprietary Carb-O-inject™ process.

The structure of the hardfacing layer shows a high content of primary chromium carbides already close to the base layer.

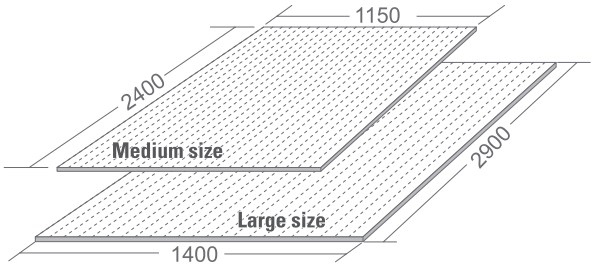


Wearplates made using conventional flux-cored wire technology

Structure of hardfaced layers manufactured using conventional flux-cored wires under similar steel to powder ratio.

The high dilution with the base material reduces the Cr and C content which leads to lower percentage of primary chromium carbides.

Production Program
for standard composite wearplates



Standard sheet sizes & thickness options

Coated surface area	
Small	900 mm x 1900 mm
Medium	1150 mm x 2400 mm
Large	1400 mm x 2900 mm
Extra large	1900 mm x 3900 mm
Custom size	Any specific size available on request

Thickness options (Base + Overlay)					
Standard	5+3	6+4	8+5	10+8	10+10
	6+3	8+4	10+5	12+8	15+10
Special	3+3	4+1	4+2	5+1	5+2
	10+15	12+20	etc.		

Backing material options

» **Structural steel**	S235JRG2 / RSt37-2 / IS:2062 / S355J2G3 / St52-3 / QStE 380 TM
» **Fine grained structural steel**	S690QL / Naxtra 70 / Weldox 700E
» **Heat resistant steel**	15Mo3 / 16Mo3
» **Stainless steel**	AISI 304 / AISI 309 / AISI 310
» **Through hardened steel**	400 BHN / 450 BHN / 500 BHN

Brief note on the importance of stress relief, contraction cracking

(also known as check cracking or shrinkage cracking)

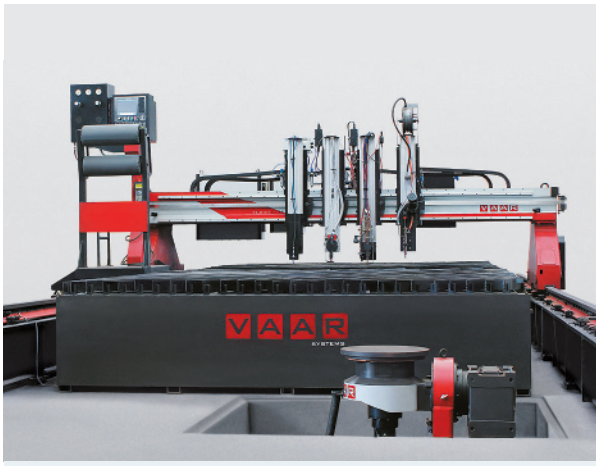
Contraction cracking occurs in high hardness and carbide bearing hardfacing alloys as a result of a large difference between the rate of expansion and contraction between it and the base material. It is normally visible to the naked eye and may not necessarily affect the performance of the component adversely.

In the harder surfacing materials providing maximum wear resistance, such cracking (relief cracking) may be encouraged to release locked-in tensile stresses. Such cracking rarely involves the risk of the coating breaking away from the base metal, provided there is no hardening of the heat affected zone, and a satisfactory bonding to the substrate has been achieved.

However, cracks cannot normally be tolerated in applications such as:

- Sealing surfaces of valves, mechanical seat rings, printing rolls, etc.
- Surfaces subject to fine particle erosion such as flow control valves
- Surfaces designed to provide both wear and corrosion resistance
- Surfaces subject to severe fatigue stresses in service
- Surfaces that must not pick up any process material that could contaminate subsequent batches, such as in plastic extrusion

Wearplate fabrication guidelines



Cutting

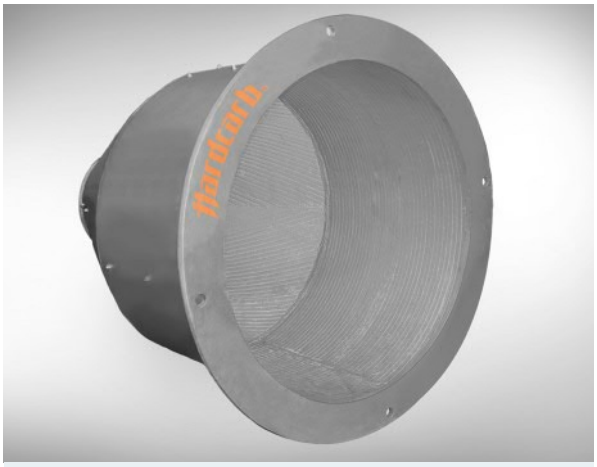
Hardcarb composite wearplates behave like stainless steel during cutting. This precludes the use of conventional shearing or oxy-fuel flame cutting processes.

Plasma Cutting: Hand held or machine mounted plasma torch can be used employing either air or inert gas. High definition plasma arc cutting is recommended where close tolerances are required.

Waterjet Cutting: High pressure waterjet with fine abrasives enable wearplates to be cut cleanly and to near-machined tolerances.

Laser Cutting: Cutting of low thickness wearplates is possible using high power laser.

Abrasive saw: Limited straight line cutting can be achieved using an abrasive saw fitted with a silicon carbide or diamond wheel.



Forming

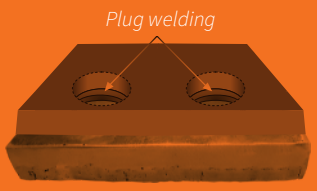
Most standard grades of Hardcarb wearplates can be cold formed into curved and conical sections using either rolls or press brakes. Thinner and thicker plates have only limited formability and a few high alloy-high hardness grades can only be used as flat profiles and fabrications.

It is strongly recommended that forming should be carried out along the direction of the overlay beads to avoid spalling.

Due to the perfectly stable and controlled production parameters, most 6+4 mm Hardcarb composite wearplates can easily be formed to diameters as low as 300 mm.

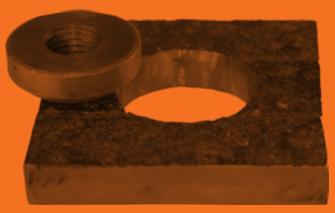
Wearplate fixing techniques
and overlay bead orientation options

Fillet welding to base material



Plug welding to base material

Counter-sunk (CSK) holes by electro-erosion



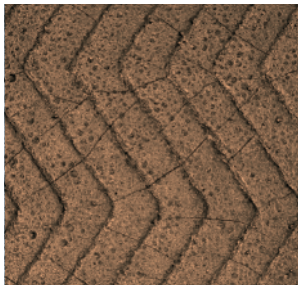
Weldable inserts

Welding of a nut with internal thread into base material

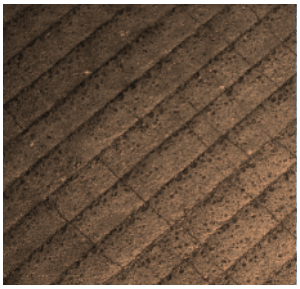
Welding-on of stud

Design your weld overlay beads for highest wear performance.

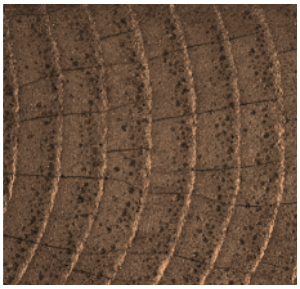
Hardcarb composite wearplates are produced on CNC machines with parametric bead orientation capabilities. Various bead orientation options allow for designing the wear parts to have least wear-prone zones. For example, in applications involving fine-dust erosion, it is important that the stress relief cracks do not occur in the direction of flow as it could lead to preferential wear attack inside the cracks.



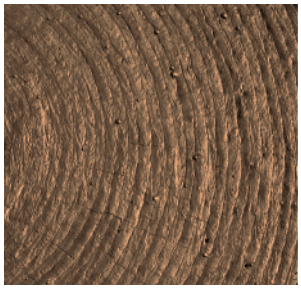
Zig-zag beads



Liner / angular beads

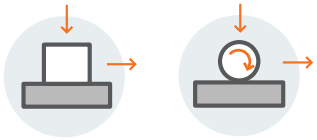


Circular beads



Spiral stringer beads

Common modes of Industrial wear



Metal - Metal Friction

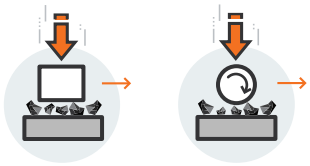
Wear caused by relative motion, direct contact and plastic deformation which create wear debris and material transfer from one metal surface to another.

Mineral Abrasion

Wear caused when mineral particles of suitable hardness, shape and texture slide across a metal surface leading to loss of material. It can be 2-body or 3-body type.

Hot Abrasion

Mineral abrasion in a high-temperature environment, leading generally to softening of the metal or its constituents.

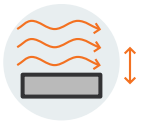


Abrasion under pressure

Wear caused when mineral particles of suitable hardness, shape and texture slide across a metal surface under high pressure leading to loss of material and superficial deformation.

Erosion

Wear caused by repetitive high-speed impact of mineral particles against the surface of an object. The impacting particles gradually remove material from the surface through repeated deformations and cutting actions.



Cavitation

Tearing out of grains from the metal surface by the formation and implosion of bubbles in a liquid in rapid motion.

Impact

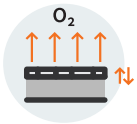
Wear due to collisions between two solid bodies where some component of the motion is perpendicular to the tangential plane of contact. This phenomenon is controlled by the toughness or ductility of the two materials.

Mechanical fatigue

Wear resulting from subsurface cracking and fracture induced by tribological stress cycles.

Thermal fatigue

Wear caused by progressive degradation of a material due to cyclic fluctuations in temperature leading to alternate expansion and contraction.



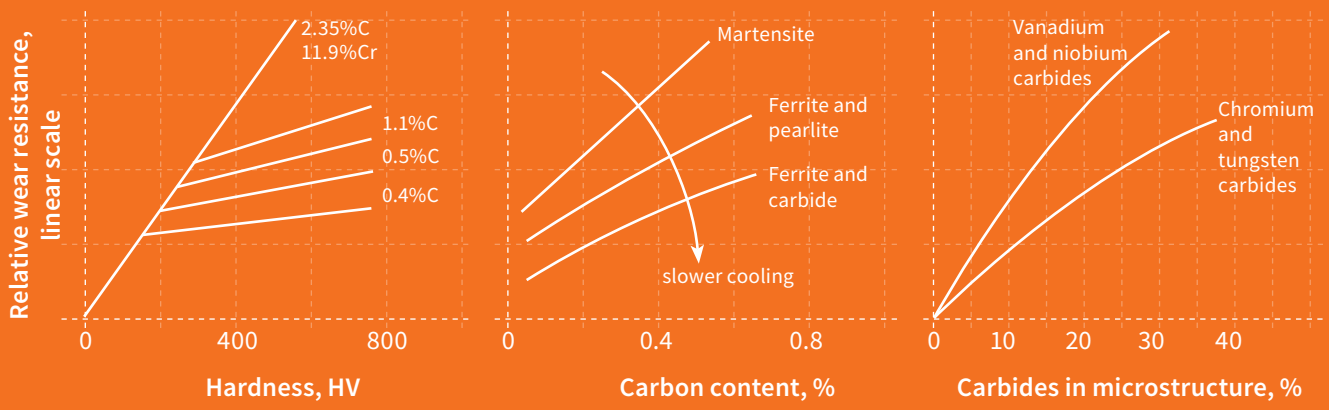
Hot oxidation

Wear caused due to cyclic formation and removal of the oxide layer (formed due to chemical reaction between metal surface and oxygen at high temperatures). Degradation is caused due to loss of thickness.

Corrosion

Wear in which chemical or electrochemical reaction with the environment is significant.

Hardness and wear



It is possible to think that wear rate should be inversely related to the hardness of hardfacing alloys. However, practical results on abrasive wear tend not to confirm this. In materials of simple microstructure, there may be a simple relation between hardness and wear rate, as has been shown, for example, in commercially pure metals. However, with materials of more complex microstructure (typified by most engineering alloys), this is not so. In steels, the relation of wear to hardness is affected by the carbon content and by the microstructure of the matrix. The presence of secondary phases in the structure is also important. Carbides especially, but also borides, are widely used with success to provide resistance to abrasion. The degree of improvement depends on the composition, amount and morphology of the hard phases (as well as upon the operating environment).

In considering hardness, the difference between the abrading body and the other surface is important from a wear perspective.

Hardness Chart
of common abrasives and mineral phases

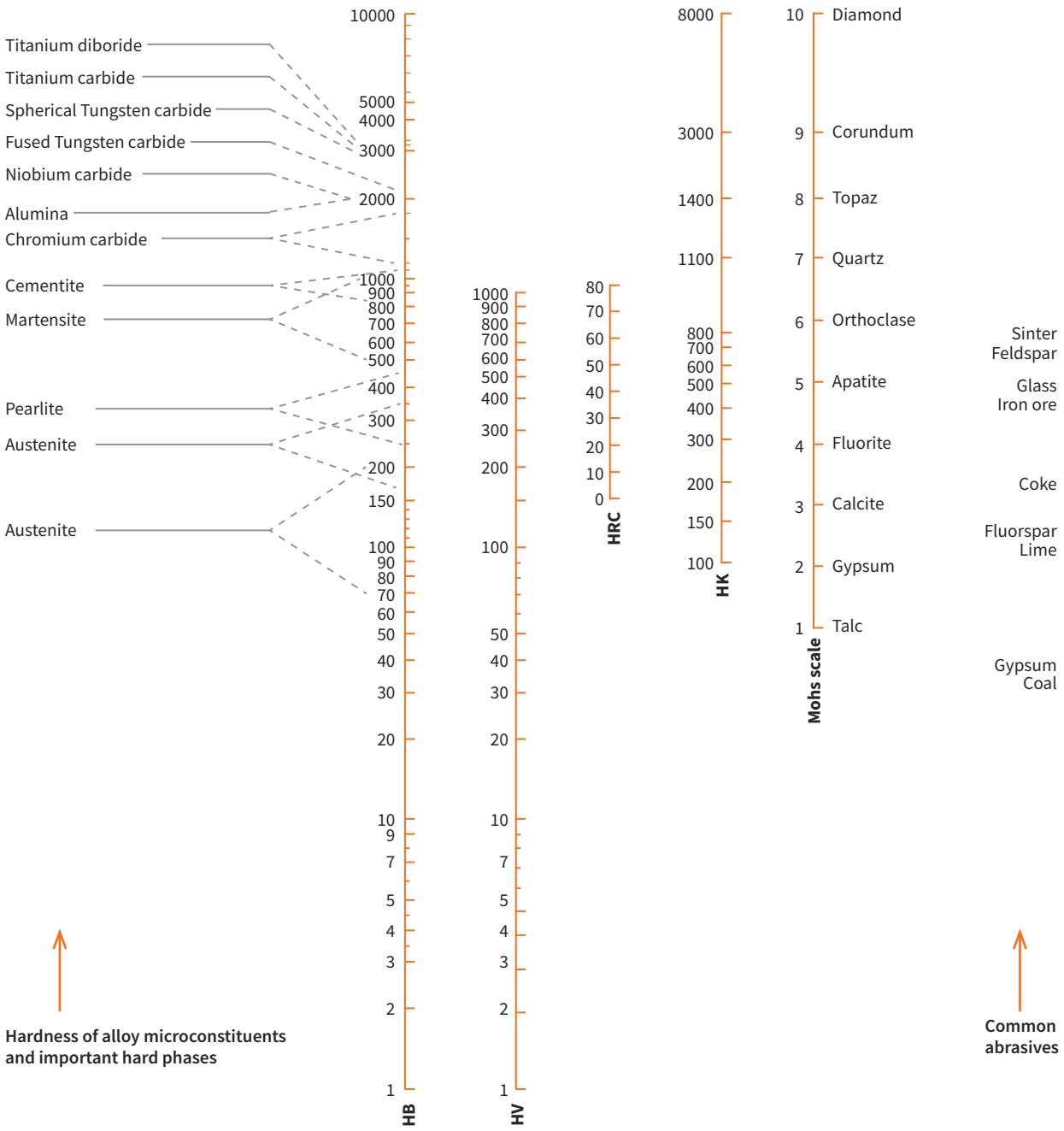


Chart for understanding various hardness scales and hardness of important minerals.
Note the limited range of most scales. Because of many factors involved, these conversions are approximate.

HARDCARB® COMPOSITE WEARPLATES
GRADE CATEGORIZATION

1	high stress, high abrasion
2	high impact, high abrasion
3	severe abrasion
4	abrasion with corrosion
5	severe abrasion with erosion
6	severe abrasion with erosion and heat
7	overalloyed complex carbide solutions
8	superalloy solutions

Product	Matching consumable / DIN Classification				Anti-Wear suitability of hard overlay											Temperature
Alloy Grade	Covered Electrode	Tubular electrode	Flux-cored wire	Other	Metal-Metal Friction	Mineral Abrasion	Hot Abrasion (>500°C)	Abrasion + Pressure	Erosion	Cavitation	Impact	Mechanical Fatigue	Thermal Fatigue	Hot oxidation	Corrosion	Application Temperature suitability
1 high stress, high abrasion																
Hardcarb® 70	DIN EN 14700 E Fe8		T Fe8		○	○		●	○		●					500°C
2 high impact, high abrasion																
Hardcarb® 180	DIN EN 14700 E Fe14		T Fe14			○					○					350°C
Hardcarb® 185	DIN EN 14700 E Fe15		T Fe15			○					○					350°C
3 severe abrasion																
Hardcarb® 190	DIN EN 14700 E Fe15	T Fe15	T Fe15			●										350°C
Hardcarb® 200	DIN EN 14700 E Fe15	T Fe15	T Fe15			●					○					400°C

○ suitable ● extremly suitable

Hard Overlay Details

Typical Applications													Hardness	Typical properties	
Alloying Basis															
C	Mn	Si	Cr	Ni	Mo	Nb	V	W	Co	Fe	+				
Chutes, high stress transfer points, hoppers, mill linings, excavator bucket linings, tractor shovel front edges, impact mill linings, etc													55 HRC	• Martensitic Chromium-titanium alloy designed to resist a combination of abrasion, high pressure and high impact. Contains extremely hard finely dispersed titanium carbides. • The overlay is crack resistant, magnetic and cannot be machined as-welded. • Suitable for application temperatures upto 500°C.	Hardcarb® 70
+	+	+	+		+					Base	Ti				
Chutes, screens, transfer points, hoppers, pipes, mill linings, bucket wheel linings, excavator bucket linings, tractor shovel front edges, impact mill linings, etc.													50 - 55 HRC	• Sub-eutectic hard alloy specially designed to resist abrasion with high impact. • The overlay exhibits cracks and cannot be machined. However, machining of the annealed material is possible. • Suitable for application temperatures upto 350°C.	Hardcarb® 180
+	+	+	+	+	+					Base					
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, excavator bucket linings, tractor shovel front edges, dust and ash ducts, fan blades and housings, etc.													56 - 62 HRC	• Martensitic matrix with a high content of Cr-Carbides having good resistance to high abrasion and medium-high impact up to 350°C. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 350°C.	Hardcarb® 185
+	+	+	+							Base	B				
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, excavator bucket linings, tractor shovel front edges, dust and ash ducts, fan blades and housings, etc.													58 - 63 HRC	• Austenitic, primary carbide-containing overlay designed to resist severe mineral abrasion with low-to-moderate impact. • The material cannot be flame cut and cannot be machined. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 350°C.	Hardcarb® 190
+	+	+	+							Base					
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, excavator bucket linings, tractor shovel front edges, dust and ash ducts, fan blades and housings, etc.													60 - 64 HRC	• Highly versatile austenitic, primary carbide-containing overlay designed for applications subject to strong abrasive wear by minerals, combined with moderate impact, medium shocks and compression. • The material cannot be flame cut, offers good resistance to scaling and cannot be machined. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 400°C.	Hardcarb® 200
+	+	+	+							Base	B				

Product	Matching consumable / DIN Classification				Anti-Wear suitability of hard overlay											Temperature
Alloy Grade	Covered Electrode	Tubular electrode	Flux-cored wire	Other	Metal-Metal Friction	Mineral Abrasion	Hot Abrasion (>500°C)	Abrasion + Pressure	Erosion	Cavitation	Impact	Mechanical Fatigue	Thermal Fatigue	Hot oxidation	Corrosion	Application Temperature suitability
4 abrasion with corrosion																
Hardcarb® 320	DIN EN 14700 E Fe14		DIN EN 14700 T Fe14			●	○		○						○	600°C
5 metal-to-earth wear / severe abrasion with erosion																
Hardcarb® 400	DIN EN 14700 E Fe15		DIN EN 14700 T Fe15			●			○							400°C
Hardcarb® 410	DIN EN 14700 E Fe15		DIN EN 14700 T Fe15			●			●							450°C
Hardcarb® 420	DIN EN 14700 E Z Fe13		DIN EN 14700 T Z Fe13			●			●							450°C
Hardcarb® 430	DIN EN 14700 E Fe15		DIN EN 14700 T Fe15			●			●							450°C
Hardcarb® 433	DIN EN 14700 E Fe15		DIN EN 14700 T Fe15			●			●							450°C

○ suitable ● extremly suitable

Hard Overlay Details

Typical Applications												Hardness	Typical properties	
Alloying Basis														
C	Mn	Si	Cr	Ni	Mo	Nb	V	W	Co	Fe	+			
Especially suited for components prone to wear in coke ovens employing wet-quenching process. Also suitable for chutes, screens, transfer points, hoppers, pipes, cyclones, fan blades and housings, etc..												58 - 63 HRC	• Suitable for applications subject to strong abrasive wear combined with moderate impact, medium shocks, elevated temperature and corrosion. • Recommended for use over stainless steel base materials. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 600°C.	Hardcarb® 320
+	+	+	+	+						Base	B			
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.												62 - 66 HRC	• Recommended particularly for areas subjected to high abrasion and erosion with little or no shock stress. Deformation of the parts after hardfacing is only limited. • Boride and carbide inclusions generate a high resistance against abrasion and fine particle erosion. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 400°C.	Hardcarb® 400
+	+	+	+							Base	B			
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.												60 - 65 HRC	• Recommended particularly for areas subjected to high abrasion and erosion with moderate shock stress. • Complex carbides in combination with borides generate a high resistance against abrasion and fine particle erosion. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 450°C.	Hardcarb® 410
+	+	+	+	+	+		+	+		Base	B			
Chutes, screens, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.												65 - 68 HRC	• Recommended particularly for parts subjected to moderate impact, metal-to-metal friction and severe fine particle abrasion as well as erosion. It gives a full martensitic deposit which is rich in iron borides and iron carbides. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 450°C.	Hardcarb® 420
+	+	+		+						Base	B			
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.												61 - 65 HRC	• High C - Cr - Nb based primary carbide-containing overlay which is extremely resistant to abrasion and erosion due to the finely dispersed hard niobium carbides. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 450°C.	Hardcarb® 430
+	+	+	+			+				Base				
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.												61 - 65 HRC	• High C - Cr - Nb - B based primary carbide-containing overlay which is extremely resistant to abrasion and erosion due to the finely dispersed hard niobium carbides and borides. • It is suitable for hardfacing of applications requiring temperature resistance of up to 450° C. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 433
+	+	+	+			+				Base	B			

Product	Matching consumable / DIN Classification				Anti-Wear suitability of hard overlay											Temperature
Alloy Grade	Covered Electrode	Tubular electrode	Flux-cored wire	Other	Metal-Metal Friction	Mineral Abrasion	Hot Abrasion (>500°C)	Abrasion + Pressure	Erosion	Cavitation	Impact	Mechanical Fatigue	Thermal Fatigue	Hot oxidation	Corrosion	Application Temperature suitability
Hardcarb® 440	DIN EN 14700 E Fe15	T Fe15	T Fe15			●			●							450°C
Hardcarb® 450	DIN EN 14700 E Fe16		T Fe16			●	○		●							500°C
Hardcarb® 460	DIN EN 14700 E Fe16		T Fe16			●	○		●							500°C
6	**severe abrasion accompanied with erosion and heat**															
Hardcarb® 700	DIN EN 14700 E Fe14		T Fe14			●	○		○							550°C
Hardcarb® 710	DIN EN 14700 E Fe14		T Fe14			●	○		●							550°C
Hardcarb® 715	DIN EN 14700 E Fe14		T Fe14			●	○		○							600°C

○ suitable ● extremly suitable

Hard Overlay Details

Typical Applications	Alloying Basis												Hardness	Typical properties	
	C	Mn	Si	Cr	Ni	Mo	Nb	V	W	Co	Fe	+			
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.	+	+	+	+			+				Base		61 - 65 HRC	• High complex carbide containing overlay which is extremely resistant to abrasion and erosion due to the finely dispersed hard niobium carbides. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 450°C.	Hardcarb® 440
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.	+	+	+	+		+	+	+	+		Base	B	62 - 66 HRC	• High complex carbide containing overlay which is extremely resistant to abrasion and erosion due to the finely dispersed hard niobium-vanadium-tungsten carbides and borides. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 500°C.	Hardcarb® 450
Chutes, screens, transfer points, hoppers, pipes, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, fan blades and housings, etc.	+	+	+	+				+			Base		62 - 66 HRC	• High C-Cr-V alloy for extreme abrasive wear even at elevated temperatures. The fine grain structure of the overlay prevents a washout of the matrix and therefore the deposit has an extreme high scratch hardness • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 500°C.	Hardcarb® 460
Chutes, screens, fan impeller and housings, coke pushers, hot dust ducts, burner tubes, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, etc.	+	+		+	+						Base		58 - 62 HRC	• Austenitic, primary carbide-containing weld deposit that is highly resistant to abrasion at elevated temperatures up to 550°C. • The increased Cr concentration and addition of Ni give the overlay an increased scale and heat resistance. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 700
Chutes, screens, fan impeller and housings, coke pushers, hot dust ducts, burner tubes, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, etc.	+	+	+	+		+	+	+	+		Base	B	62 - 66 HRC	• High complex carbide containing overlay which is extremely resistant to abrasion and erosion due to the finely dispersed hard niobium-vanadium-tungsten carbides and borides. • It is suitable for hardfacing of applications requiring temperature resistance of up to 550° C. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 710
Chutes, screens, fan impeller and housings, coke pushers, hot dust ducts, burner tubes, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, etc.	+	+	+	+	+		+	+			Base	B	61 - 65 HRC	• Austenitic, primary carbide-containing weld deposit that is highly resistant to abrasion at elevated temperatures up to 600°C. • The increased Cr concentration give the overlay an increased scale and heat resistance. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 715

Product	Matching consumable / DIN Classification				Anti-Wear suitability of hard overlay										Temperature
Alloy Grade	Covered Electrode	Tubular electrode	Flux-cored wire	Other	Metal-Metal Friction	Mineral Abrasion	Hot Abrasion (>500°C)	Abrasion + Pressure	Erosion	Cavitation	Impact	Mechanical Fatigue	Thermal Fatigue	Hot oxidation	Corrosion	Application Temperature suitability
Hardcarb® 735	DIN EN 14700 E Fe16		T Fe16			●	●	○	○		○					700°C
Hardcarb® 750	DIN EN 14700 E Fe16		T Fe16			●	●	○	●		○					750°C
Hardcarb® 760	DIN EN 14700 E Fe16		T Fe16			●	●		●							650°C
Hardcarb® 770	DIN EN 14700 E Fe16		T Fe16			●	●		●							800°C

7 overalloyed complex carbide solutions

Hardcarb® 1000	DIN EN 14700 E Z Fe16		T Z Fe16			●			●							400°C
Hardcarb® 1500	DIN EN 14700 E Z Fe16		T Z Fe16			●	○		●							550°C

○ suitable ● extremly suitable

Hard Overlay Details

Typical Applications	Alloying Basis												Hardness	Typical properties	
	C	Mn	Si	Cr	Ni	Mo	Nb	V	W	Co	Fe	+			
Chutes, hot sinter screens, coke pushers, hot dust ducts, burner tubes, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, crash decks, exhaust fan blades in pellet plants and boilers, etc.	+	+	+	+		+	+	+	+		Base		62 - 66 HRC	• C-Cr-Nb-Mo alloy with addition of tungsten and vanadium designed to resist high stress grinding abrasion with moderate impact and solid particle erosion at service temperatures up to 700 °C. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 735
Chutes, hot sinter screens, coke pushers, hot dust ducts, burner tubes and nozzles, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, crash decks, exhaust fan blades in pellet plants and boilers, etc.	+	+	+	+		+	+	+	+		Base		63 - 66 HRC	• C-Cr-Nb-Mo alloy with addition of tungsten and vanadium designed to resist high stress grinding abrasion with moderate impact and solid particle erosion at service temperatures up to 750°C. • The hardness reduction at a temperature of 400°C is approximately 4% and at 650°C approximately 10 %. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 750
Chutes, hot sinter screens, coke pushers, hot dust ducts, burner tubes and nozzles, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, crash decks, exhaust fan blades in pellet plants and boilers, etc	+	+	+	+			+	+			Base	B	65 - 70 HRC	• C-Cr-V-Nb alloy designed to surface parts subject to high stress grinding abrasion without impact up to high temperatures (up to 650 °C). • Hardness Reduction at 400°C app 7%. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 760
Chutes, hot sinter screens, coke pushers, hot dust ducts, burner tubes and nozzles, blast furnace armour plates, gas cleaning systems, sinter feeding drums, sinter crusher bars, crash decks, exhaust fan blades in pellet plants and boilers, etc	+	+	+	+		+					Base	B	65 - 70 HRC	• Very high C-Cr-B alloy for hardfacing against very high mineral wear also at high temperatures up to 800°C. • The overlay has a ledeburitic structure with large percentage of hypereutectic carbides. • The overlay exhibits cracks and cannot be machined. • Hardness Reduction at 400°C is approximately 5% and at 600°C is approximately 10%.	Hardcarb® 770
Exhaust fans with high percentage of abrasive dust, screens, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, etc.	+	+	+	+			+		+		Base		65 - 70 HRC	• High C-Cr-Nb-W alloy for hardfacing against very high mineral wear and erosion. • The overlay has a large percentage of hypereutectic carbides. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 400°C.	Hardcarb® 1000
Exhaust fans with high percentage of abrasive dust, screens, concrete mixers, mill linings, cyclones, separators, bucket-wheel linings, dust and ash ducts, etc.	+	+	+	+		+	+		+		Base		65 - 70 HRC	• High C-Cr-Nb-W alloy for hardfacing against very high mineral wear and erosion at elevated temperatures up to 550°C. • The overlay has a large percentage of hypereutectic carbides. • The overlay exhibits cracks and cannot be machined.	Hardcarb® 1500

8 superalloy solutions for the most demanding wear problems

Product	Matching consumable / DIN Classification				Anti-Wear suitability of hard overlay										Temperature
Alloy Grade	Covered Electrode	Tubular electrode	Flux-cored wire	Other	Metal-Metal Friction	Mineral Abrasion	Hot Abrasion (>500°C)	Abrasion + Pressure	Erosion	Cavitation	Impact	Mechanical Fatigue	Thermal Fatigue	Hot oxidation	Corrosion	Application Temperature suitability
Hardcarb® 3100	DIN EN 14700 E Z Fe16		T Z Fe16			●	●		●		○			○		700°C
Hardcarb® 3500	DIN EN 14700 E Z Fe16		T Z Fe16			●	●		●		○			●		800°C
Hardcarb® 4000	DIN EN 14700 E Z Fe16		T Z Fe16			●	●		●		○			●		850°C
Hardcarb® 6000	DIN EN 14700		T Fe20			●			○							350°C
Hardcarb® 7999	DIN EN 14700			E Ni20		●	●		●						●	550°C

○ suitable ● extremly suitable

Hard Overlay Details				
Typical Applications		Hardness	Typical properties	
Alloying Basis				
Matrix	Hard Phase			
Exhaust fans, hot dust ducts, vibro-screens, classifier vanes, sinter crushers. Recommended for single layer hardfacing as overalloying enables high hardness and good properties in first layer itself.		66 - 69 HRC	• Iron based steel superalloy with a near nanoscale (submicron) microstructure. The alloy is extremely abrasion and erosion resistant, contains high volume of hard phases and exhibits superior high temperature hardness upto 700°C. • The overlay exhibits cracks and cannot be machined. • Provides exceptional wear resistance lasting significantly longer than most chrome and complex carbide alloys.	Hardcarb® 3100
Fe based	Special			
Exhaust fans handling high percentage of dust moving at high velocities, furnace chutes, cyclones, paddles, mixer blades, classifier vanes, waste recycling components, sinter crushers and bars, hot vibro-screens, burner tubes and nozzles, etc.		67 - 70 HRC	• Iron based steel superalloy with a near nanoscale (submicron) microstructure. The alloy is extremely abrasion and erosion resistant, contains high volume of hard phases and exhibits superior high temperature hardness upto 800°C. • The overlay exhibits cracks and cannot be machined. • Designed to be a low cost replacement of iron-based tungsten carbide materials for relevant applications.	Hardcarb® 3500
Fe based	Special			
Exhaust fans handling high percentage of dust moving at high velocities, furnace chutes, cyclones, paddles, mixer blades, classifier vanes, waste recycling components, sinter crushers and bars, hot vibro-screens, burner tubes and nozzles, etc.		69 - 72 HRC	• Iron based steel superalloy with a near nanoscale (submicron) microstructure. The alloy is extremely abrasion and erosion resistant, contains high volume of hard phases and exhibits superior high temperature hardness upto 850°C. • The overlay exhibits cracks and cannot be machined. • Designed to be a low cost replacement of nickel-based tungsten carbide materials for relevant applications.	Hardcarb® 4000
Fe based	Special			
For hardfacing tools and machine parts that are exposed to wear in mining, excavation, earth moving, road construction, tunneling shields, well drilling and deep drilling applications		66 - 69 HRC	• Iron based superalloy containing high proportion of Fused Tungsten Carbides. • The alloy is extremely abrasion and erosion resistant, contains high volume of hard phases and is suitable for applications where complex carbides fail. • The overlay exhibits cracks and cannot be machined. • Suitable for application temperatures upto 350°C.	Hardcarb® 6000
Fe matrix	Fused Tungsten Carbide			
Hardfacing on tools and parts made of ferritic and austenitic steels, e.g. mixing blades, grinding plates, stabilizers in petroleum exploration, slurry pump valves, sand preparation plants, etc.		45 HRC (Matrix) ~ 3000 HV (STC)	• Ni-Cr-B-Si based superalloy containing high proportion of ultra-hard Spherical Tungsten Carbides. • The alloy is extremely abrasion, erosion and corrosion resistant; contains high volume of hard phases and is suitable for severest wear conditions including those under high pressures. • The Ni-base matrix alloy provides excellent resistance to acids and alkaline-corrosive media.	Hardcarb® 7999
NiCrBSi matrix	Spherical Tungsten Carbide			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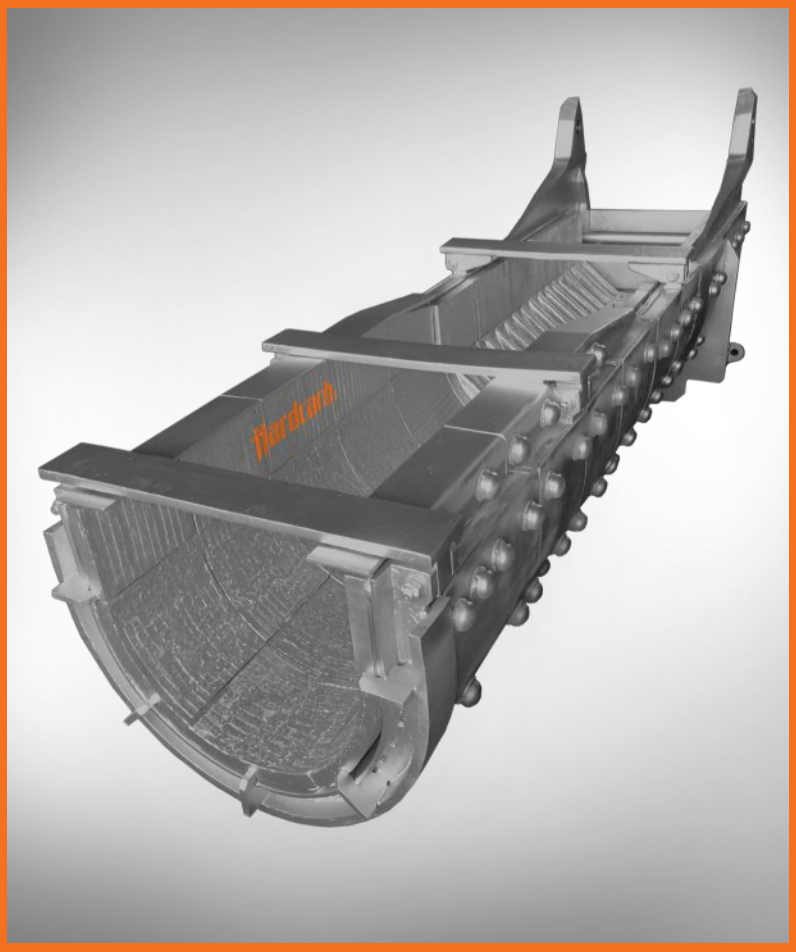
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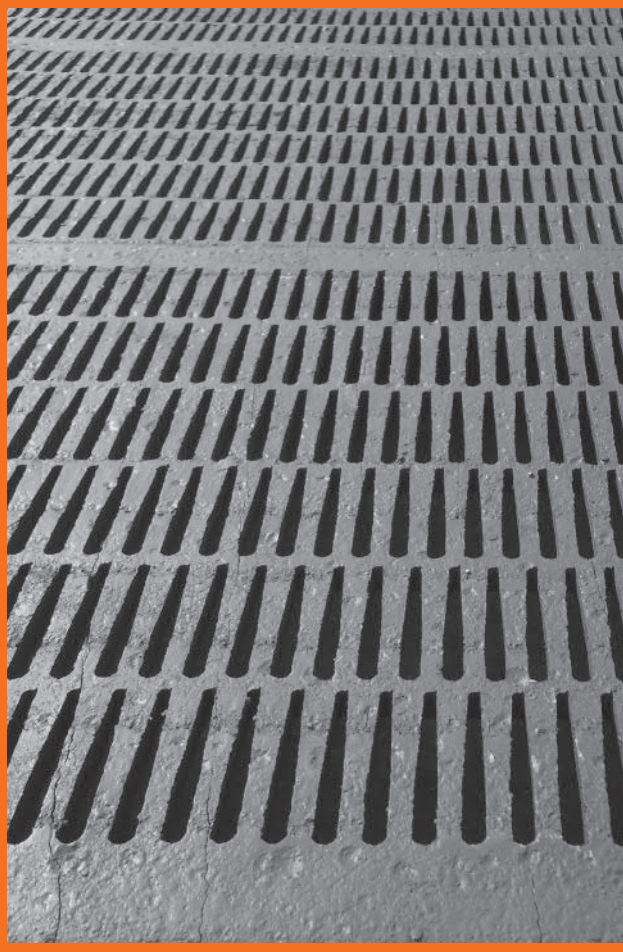
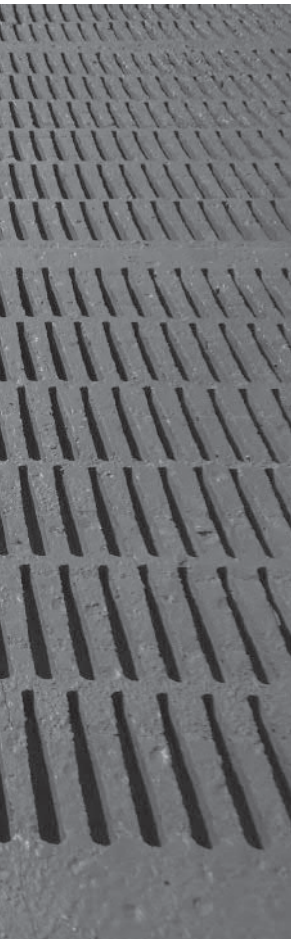
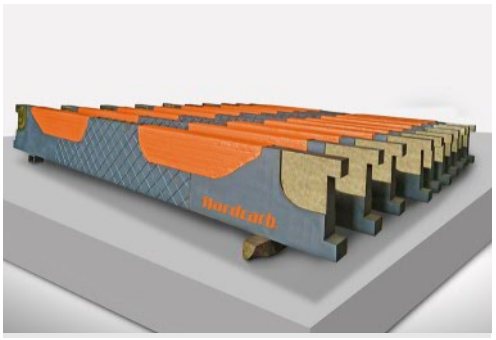


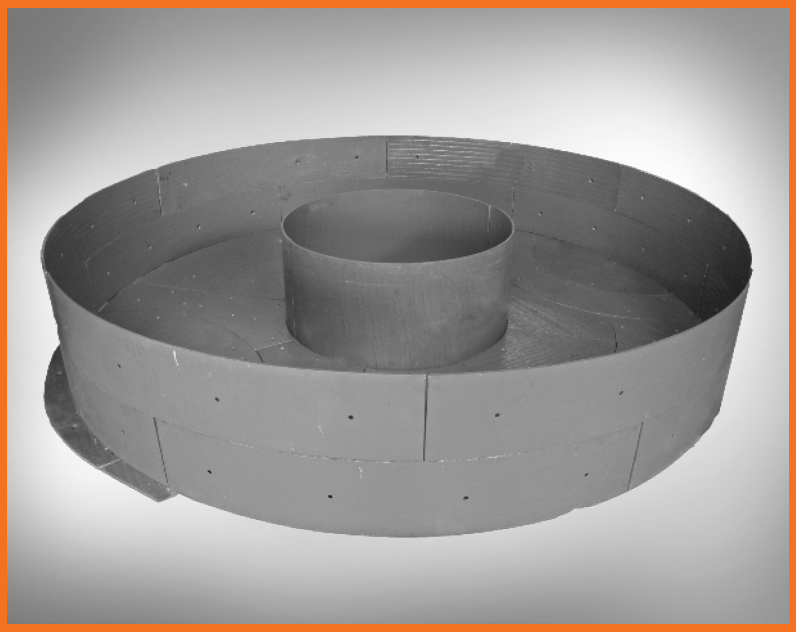
APPLICATION PORTFOLIO

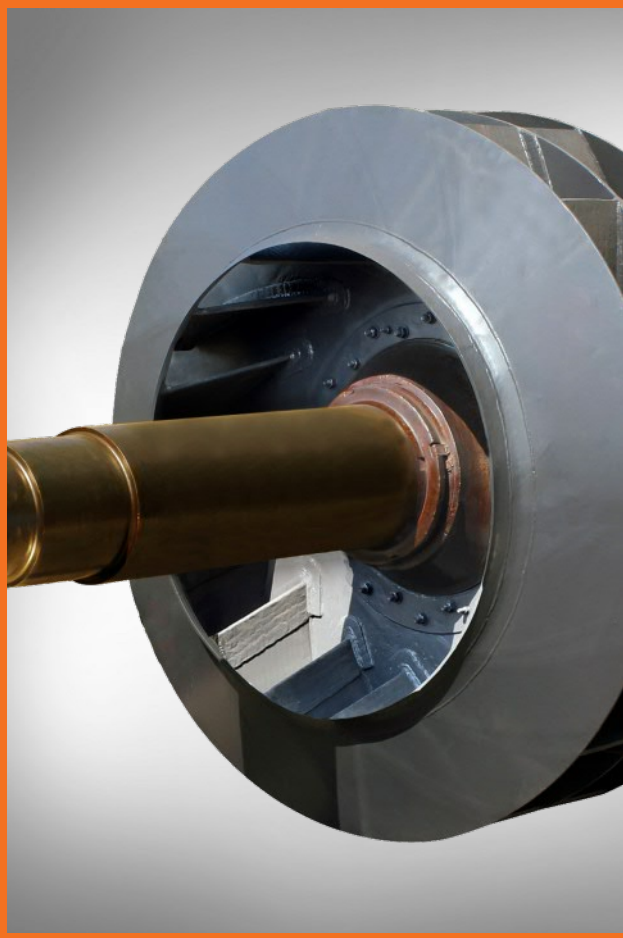
Iron & Steel Industry

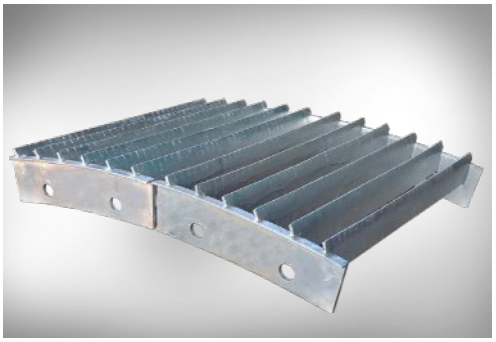


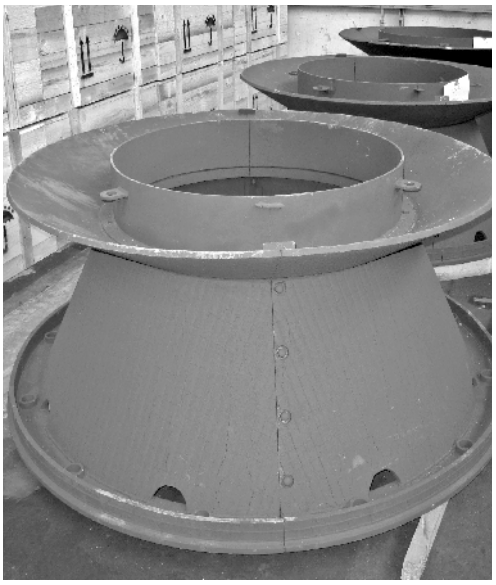


- Sinter crushers
- Grizzly bars
- Crash decks
- Sinter screen mats
- Coke screen mats
- Blast furnace charging chutes
- Ducts
- Hoppers
- Dedusting fans
- Waste gas fans





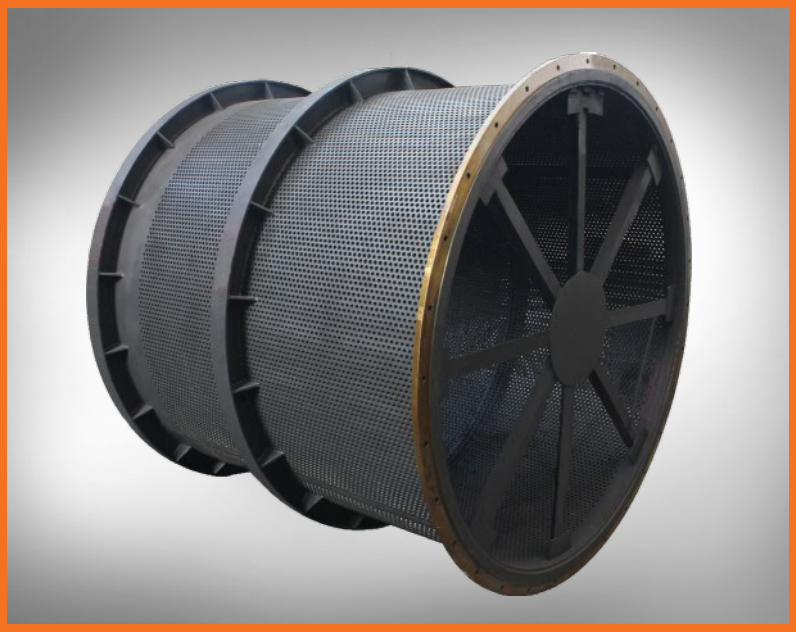


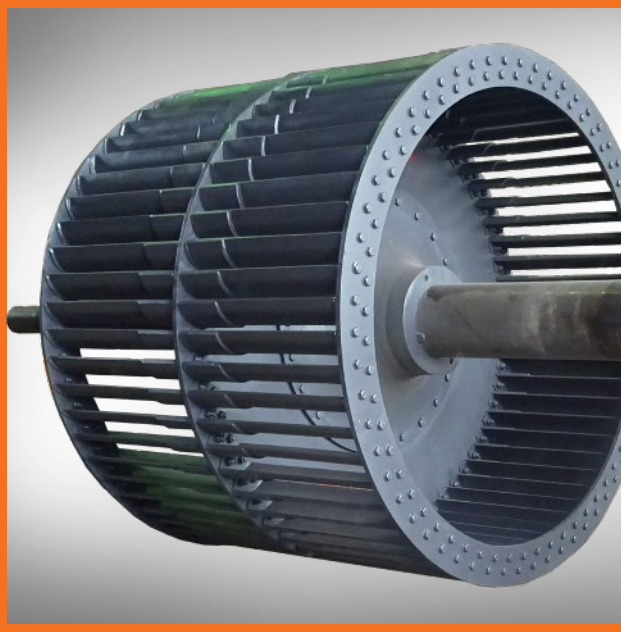


APPLICATION PORTFOLIO

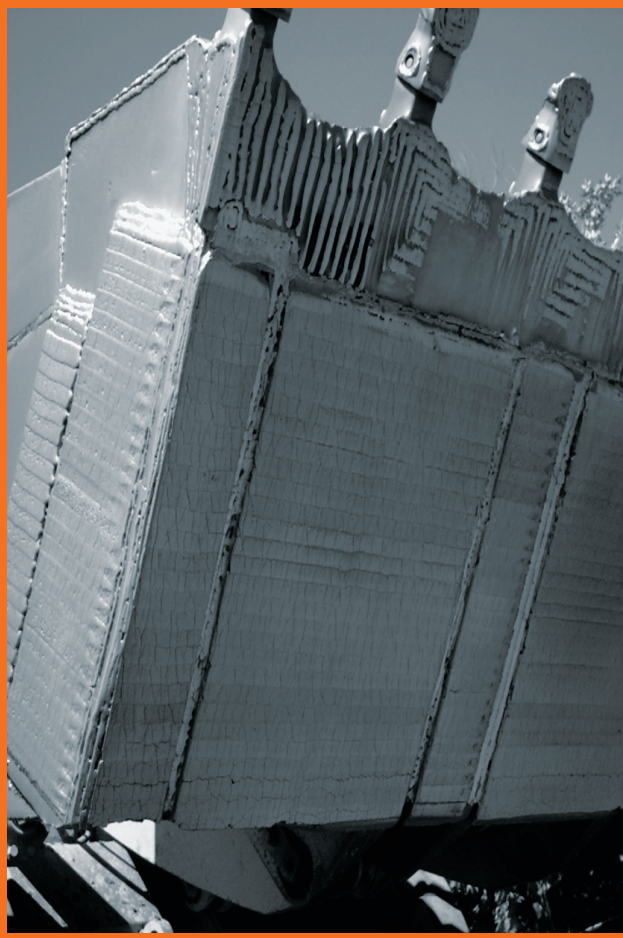
Cement, Concrete Industry

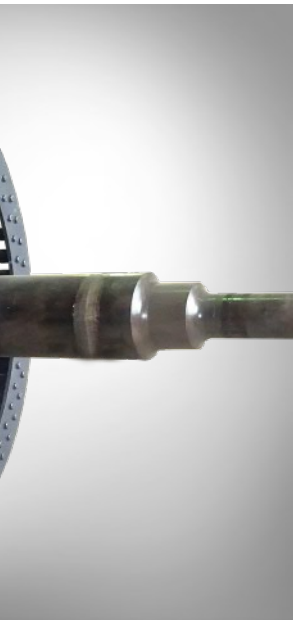
- Vertical Mill liners
- Separator linings
- Classifier cassettes
- Guide vanes
- Roller hub guards
- Grit cones
- Cylones
- Chutes
- Separator fans
- Pan mixer linings
- Twin-shaft mixer linings

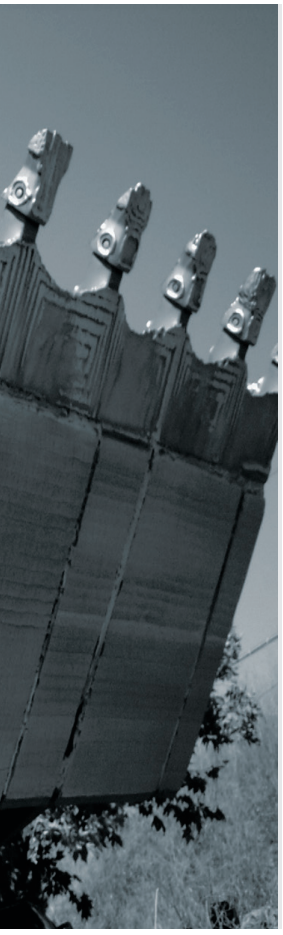


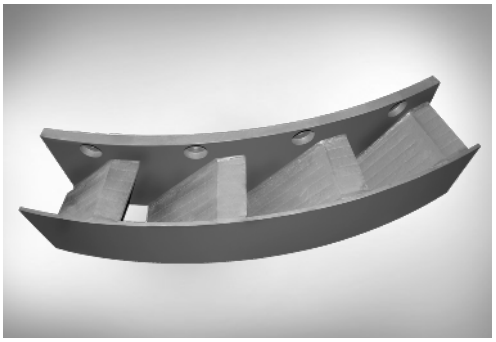


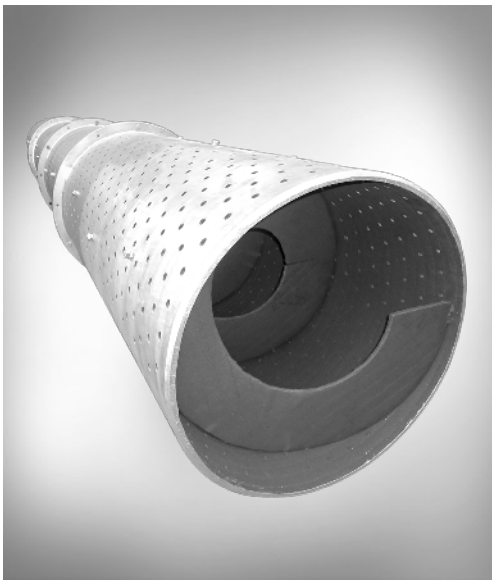

Tunnelling Systems











APPLICATION PORTFOLIO

Other Industries

- Wear pads on TBM‘s
- Excavator linings
- Screw conveyors
- Rotary screens
- Piping and elbows
- Beater bars for lignite
- Glass cullet chutes
- Vibratory conveyors
- Intensive mixer liners
- Vane wheel segments

Contact Us

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