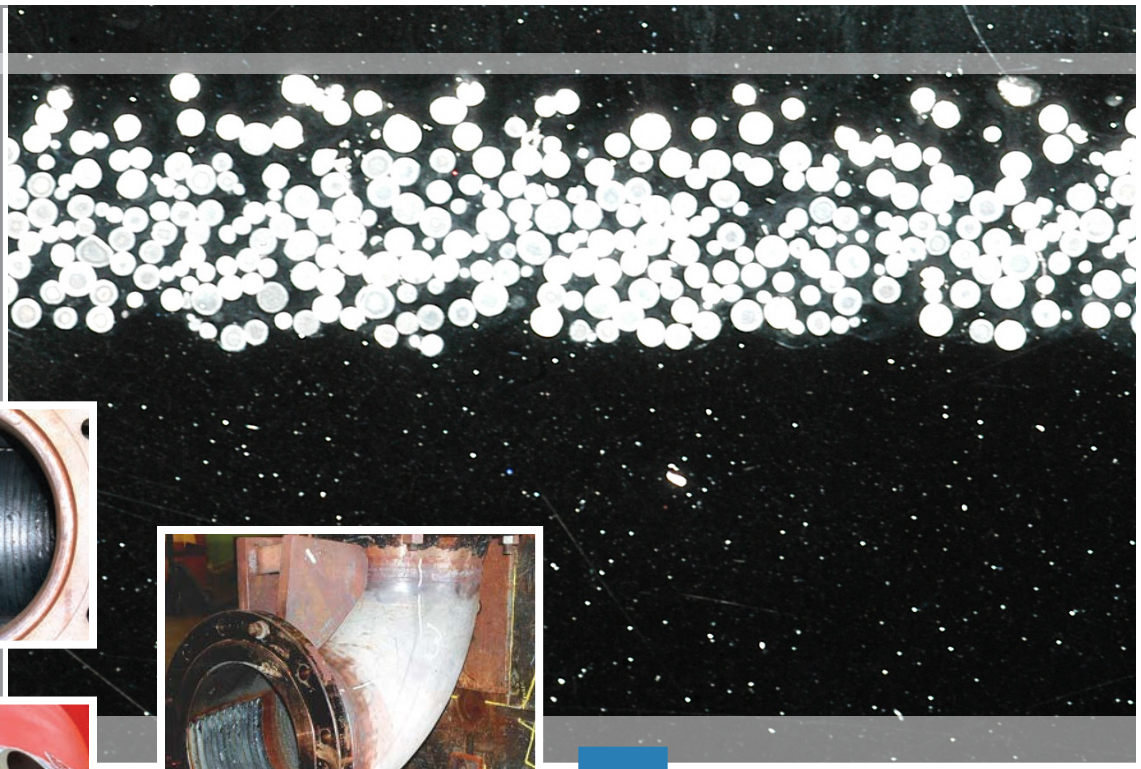
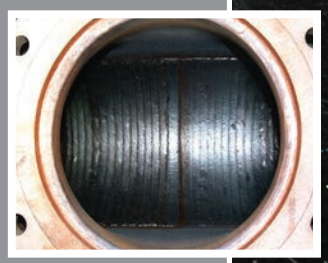
VALVTECHNOLOGIES



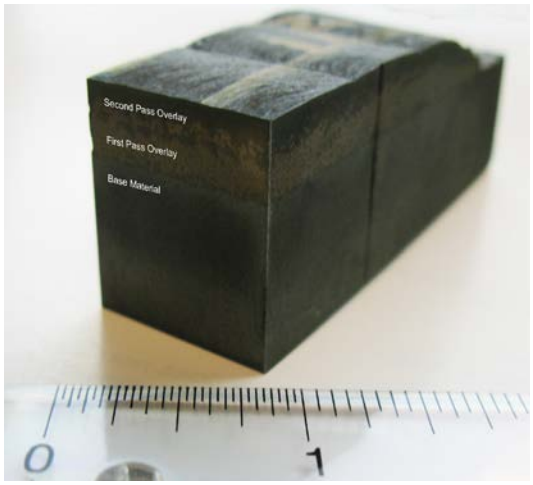


Rhinoite®

Tungsten Carbide Hardfacing

Rhinoite®

Rhinoite® is a patented process that wears five to seven times longer in service operation than bare metal.



The Rhinoite® process is an innovative, patented MIG weld overlay that utilizes state of the art equipment — producing extraordinary results.

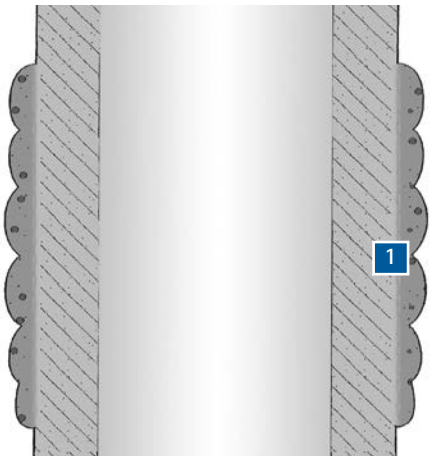
The process can be adapted to all service environments, in every wear application: erosion, corrosion, adhesion and high temperature applications (2200°F). Rhinoite® has been a proven leader of hard metal overlay on elbows, t-sections and choke tubes in chemical plants and refineries for the past six years with zero failures. The Rhinoite® weld process focuses on minimizing loss of production time by wearing five to seven times longer than bare metal. Rhinoite® overlays can be completely refurbished after years of service, reducing overall material and maintenance costs.

Rhinoite® Provides Bottom-line Cost Savings

- Minimizes loss of production time by wearing five to seven times longer in service operations than bare metal
- Reduces number of shutdowns servicing times to years rather than months
- Eliminates equipment rentals, insulation replacement, and inspection frequency
- Reduces required man-hours for overall maintenance of units
- Reduces overall material cost by being able to be completely refurbished after years of service; eliminating the need to purchase new components

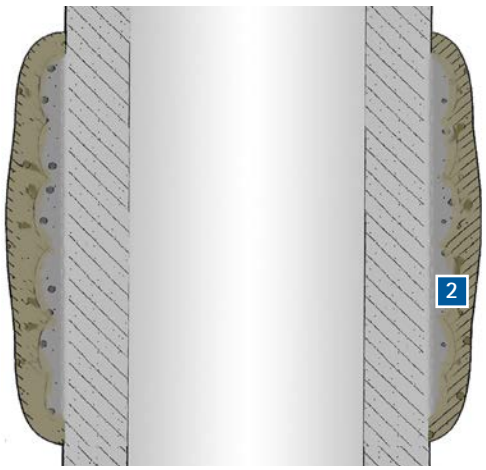
Rhinoite® Weld Hardfacing Application Process

1 Pre-heating of component.
Selection of weld material; carbon steel, stainless steel, Duplex steel, Colmonoy and Inconel. The component has been preheated. The first pass of overlay is weld wire plus carbide content.

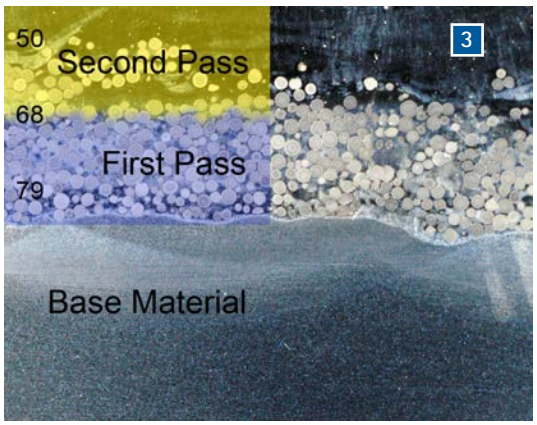


2 Step two, second pass.
Overlaying of first pass with weld material only (zero carbide). The second pass normalizes the first pass with base material, minimizing the Heat Affected Zone (HAZ) with base material. The first pass then becomes molecularly homogeneous with the base material.

This process establishes the matrix of the overlay. A percentage of the saturated carbide is diluted, with the remainder migrating to form a new alloy material called the matrix.



3 Finishing overlay to desired dimensions.
Outside diameter dimensions are accomplished by diamond grinding only. Inside diameter dimensions, depending upon application, are generally left as welded. Vertical grinding is available upon request, based upon diameter and length of product.



Applications

Elbows
Pumps
Valves
Stabilizers
Bearings
T-Sections
Furnace Bends
Furnace Caps
Coker Nozzles
Choker Tubes

Exceptional Wear Resistance

Pictured left: *Syngas choker tube processes water discharge at 9,000 psi / 800°F. Duplex 312 stainless steel overlay.*

Pictured right: *a 12" diameter Flexi-Coker 90 degree short radius elbow. It can process coke particles in excess of 600 feet per second and at approximately 400°F. Overlay is .350 thick and Duplex 312 stainless steel.*

The Rhinoite® weld process has been subject to extensive corrosion and erosion testing. Once tested for 2000 hours with direct salt spray fog, microscopic examination of the carbide coated surfaces at the interim inspection showed little to no effect on the carbide surfaces throughout the test period. Additionally, upon removal of the Rhinoite® overlaid products after glass bead abrasive blasting, the component surfaces were virtually unaffected. (AS B117 - 90 - Standard Test Method of Salt Spray)

Test Parameters

- 48,000 psi water jet
- 250 g/min of 80 mesh fresh garnet
- .040" diamond orifice @ 1/8" stand-off with 1/8" min traverse speed
- Depth of kerf in Rhinoite® - .025/.050"
- Comparable wear resistance: 1/4" Rhinoite® = 16" Inconel 718

Pictured left: *6" diameter short radius furnace bend. Duplex 312 stainless steel overlay, base material 304H.*

Pictured right: *5" in length radius furnace bends. The overlay is Duplex 312 stainless. These bends operate at 1200°F.*

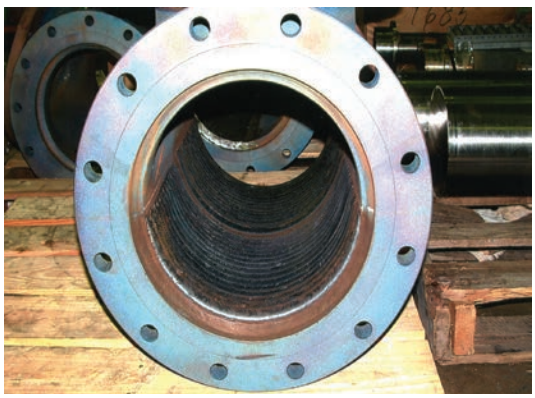
Rhinoite® Hardfacing

Pictured left: *is a 14" diameter, Flexi-Coker t-section.*

Pictured right: *is a 5" diameter 304H stainless steel, short radius furnace bend. This elbow's operating temperature is 1200°F. The Rhinoite®™ weld overlay makes it extremely fluid erosion resistant.*

Using a MIG weld process an initial overlay of mild steel wire with dispersed cemented metal carbide pellets is applied to a base material. As the second pass is applied, a portion of the hard metal particles in the first overlay are dispersed in the weld puddle forming the Rhinoite® matrix. The result is a steel hybrid matrix that can be diamond ground down to desired dimensions. The process provides improvements in wear resistance that enable the component to have an extended service life even when used in highly erosive and/or corrosive environments.

- Custom matrix of duplex stainless steel, 309L stainless, carbon steel, Inconel, Colomony 56, tool steel and nickle alloys
- Tungsten carbide content up to 80% weight
- Fluid erosion resistant
- Corrosion resistant
- Oxidation resistant
- Hot hardness - 1200°F
- Thickness up to 5/8"



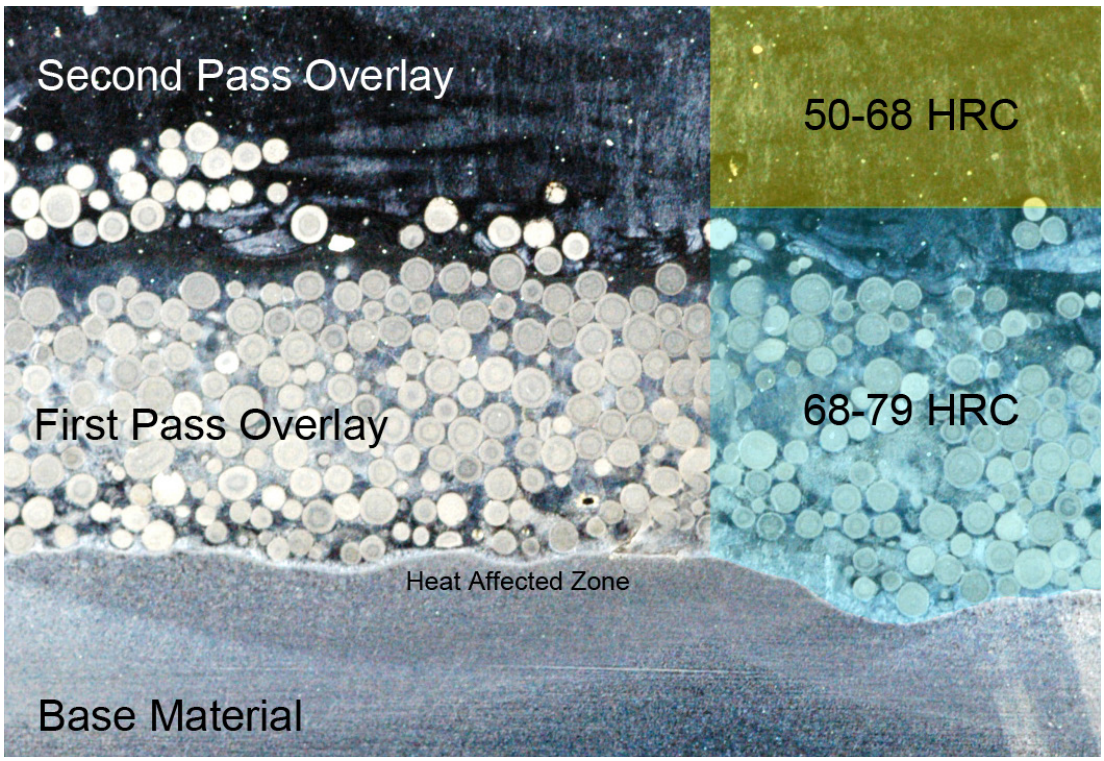
Pictured left: *is a 10" diameter, de-coke t-section. The overlay is 200 degree grid, .350 thick.*

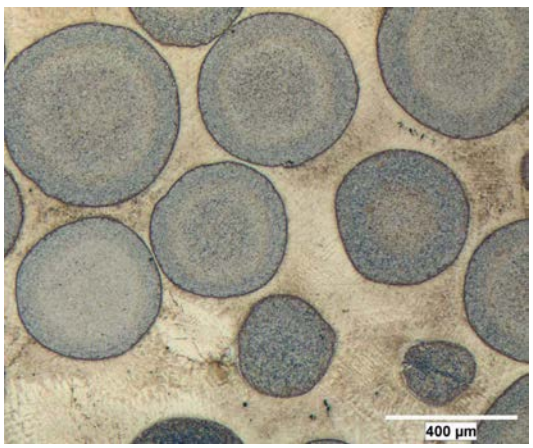
Pictured right: *is a coker scrubber nozzle, 316 stainless steel, Duplex 312 overlay. This nozzle can process 3,000 gallons of water per minute.*

Rhinoite® Hardfacing

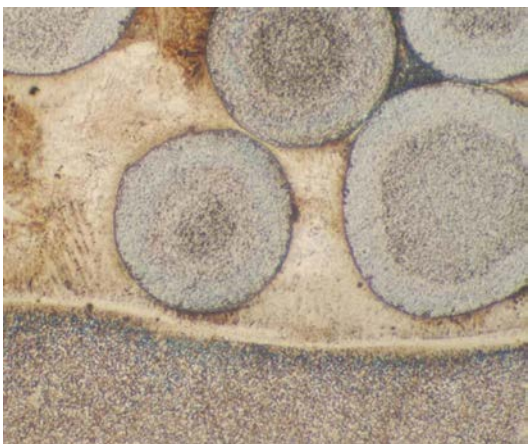
Cross Section

The second pass of the overlay acts as an oven baking the first pass of the overlay releasing tungsten particles into the matrix





50X zoom showing tungsten pellets in the matrix. Notice the inner-ring shape of the pellets where the molecular reaction releases the tungsten into the matrix.



50X Zoom showing pellets next to Substrate condition of heat affected zone showing no cracking or stress.

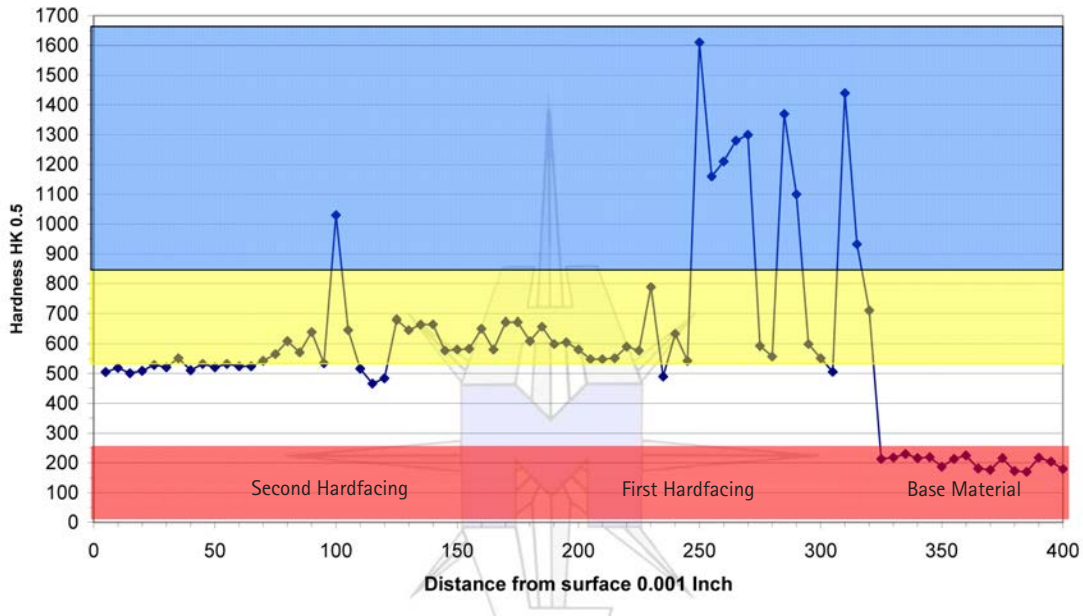
Hardness Profile

RHINOITE ™ HARDFACING
DATE OF TEST: 01/04/11
REPORT OF HARDNESS PROFILE

KNOOP 0.5 Kg (500 g) LOAD TEST RESULTS
HRB Readings in RED

SPECIMEN NO:	#	Distance from surface inches	Reading HK 0.5	HRC Converted	#	Distance from surface inches	Reading HK 0.5	HRC Converted	#	Distance from surface inches	Reading HK 0.5	HRC Converted
1558-10	1	0.005	505	48	28	0.140	665	57	55	0.275	593	53
	2	0.010	519	49	29	0.145	577	52	56	0.280	557	51
	3	0.015	501	47	30	0.150	580	52	57	0.285	1370	<80
	4	0.020	509	48	31	0.155	583	52	58	0.290	1100	<80
	5	0.025	529	49	32	0.160	650	56	59	0.295	599	53
	6	0.030	521	49	33	0.165	580	52	60	0.300	551	51
	7	0.035	551	51	34	0.170	672	57	61	0.305	506	48
	8	0.040	511	48	35	0.175	672	57	62	0.310	1440	<80
	9	0.045	532	49	36	0.180	609	54	53	0.315	932	<80
	10	0.050	521	49	37	0.185	657	56	64	0.320	710	59
	11	0.055	532	49	38	0.190	599	53	65	0.325	Hit Base Material	
	12	0.060	524	49	38	0.195	605	54	66	0.330	HRB Scale	
	13	0.065	524	49	40	0.200	580	52	67	0.335	Not Converted	
	14	0.070	543	50	41	0.205	548	50	68	0.340	216	93
	14	0.075	565	51	42	0.210	548	50	69	0.345	219	94
	16	0.080	609	54	43	0.215	551	51	70	0.350	187	87
	17	0.085	571	52	44	0.220	590	53	71	0.355	213	92
	18	0.090	639	56	45	0.225	577	52	72	0.360	225	95
	19	0.095	535	50	46	0.230	788	62	73	0.365	181	85
	20	0.100	1030	<80	47	0.235	490	47	74	0.370	176	84
	21	0.105	646	56	48	0.240	633	55	75	0.375	216	93
	22	0.110	516	48	49	0.245	543	50	76	0.380	172	83
	23	0.115	466	45	50	0.250	1610	<80	77	0.385	170	82
	24	0.120	484	46	51	0.255	1160	<80	78	0.390	217	93
	25	0.125	680	58	52	0.260	1210	<80	79	0.395	204	91
	26	0.130	646	56	53	0.265	1280	<80	80	0.400	179	85
	27	0.135	664	57	54	0.270	1300	<80				

Readings <50 are not highlighted
Readings 50-68 are highlighted in Yellow
Readings 68-79 are highlighted in Blue
Readings >80 are highlighted in Red and are HRB and not HRC



A full report of the Rhinoite® hardness test results can be requested by contacting:
sales@valv.com
+1 713 860 0400

Note: The surface hardens as it wears down towards the molecular structure of the Rhinoite® hardfacing layer as it gets closer to the base material.

Rhinoite®

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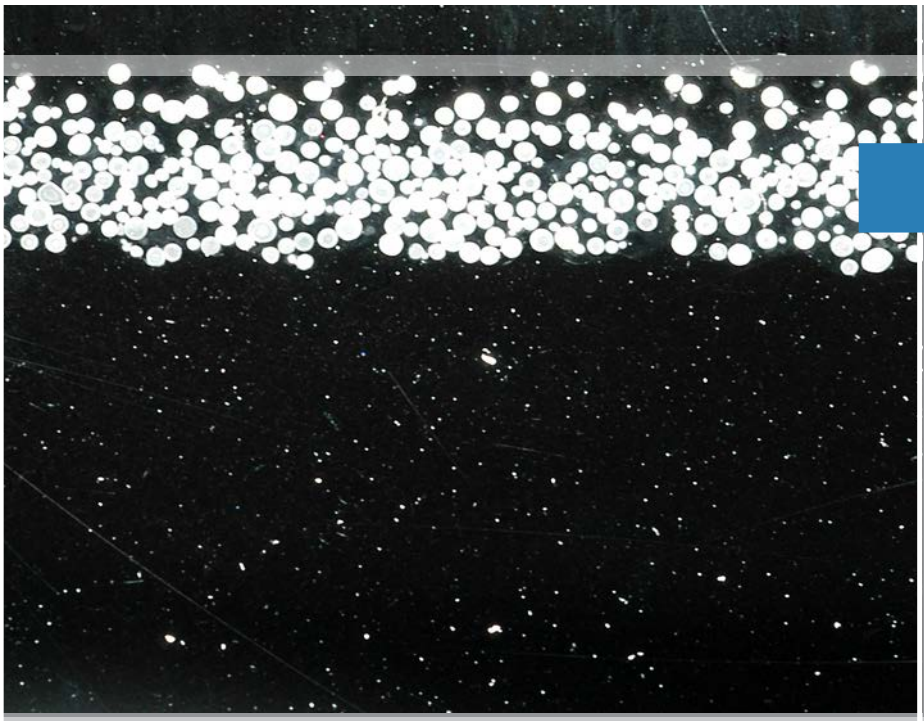

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