

Standard Conforma Clad™ Tungsten Carbide Formulations

Engineering Formulas

Kennametal has compiled over 20 years of scientific testing to develop three standard tungsten carbide cladding formulas to protect your equipment from multiple modes of wear, including abrasion, erosion, and corrosion. Our engineers evaluate components and their operating environments in order to recommend a standard cladding formula, or create a custom cladding to meet your specific requirements.

Our unique brazing process combines the hardness of tungsten carbide with the corrosion resistance of nickel chrome boron to create a protective barrier with unmatched wear-resistant properties. With a metallurgical bond strength in excess of 70,000 psi, our cladding is extremely resilient to chipping, cracking, and flaking.

Cladding Specifications

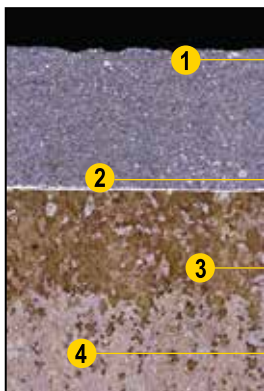
Cladding Composition (Weight Percentage)			
	WC 200	WC 210	WC 219
Tungsten Carbide*	62%	55%	48%
Nickel	30%	34%	39%
Chromium	6%	7%	8%
Other	2%	4%	5%
Total carbide loading from other carbide formation	68%	66%	62%

*Tungsten Carbide (WC) includes cobalt-bonded WC.

Cladding Properties			
	WC 200	WC 210	WC 219
Density (lb/in ³)	0.44	0.42	0.40
Thermal Conductivity (BTU in/h-ft ² -°F)	230	200	170
Metallurgical Bond Strength (psi)	>70,000	>70,000	>70,000
Porosity	<3%	<3%	<3%
Rockwell Hardness (HRC)**	64–70	60–66	56–62

**Cladding is a composite of tungsten carbide particles dispersed in a nickel-based alloy matrix. The extremely hard carbide particles, with a Vickers Diamond Pyramid Hardness of about 2000 DPH₅₀₀ [1865 DPH₅₀₀ is equivalent to 80 Rockwell C Hardness (HRC)], are surrounded by a two-phase matrix (300–800 DPH₅₀₀, equivalent to 30–64 HRC). Because of the heterogeneous structure of the cladding, direct Rockwell hardness measurements are an average of the hard particles and matrix and are not representative of the individual components of the composite.

Cladding Photomicrograph



CLADDING

Dense tungsten carbide loading with uniform carbide distribution. High wear resistance with predictable wear rates and continuous operation up to 1900°F.
No interconnected porosity. Superior corrosion and impact resistance.

BOND LINE

True metallurgical bond (>70,000 psi) with high interparticle bond strength. Provides unsurpassed strength and prevents chipping, flaking, and check-cracking.

DIFFUSION ZONE

Minimal dilution. Substrate retains uniform properties in diffusion zone.

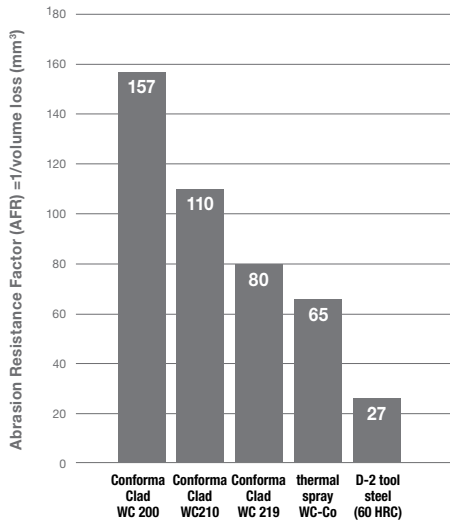
SUBSTRATE

Heat treatable. After cladding process to restore substrate's mechanical properties.



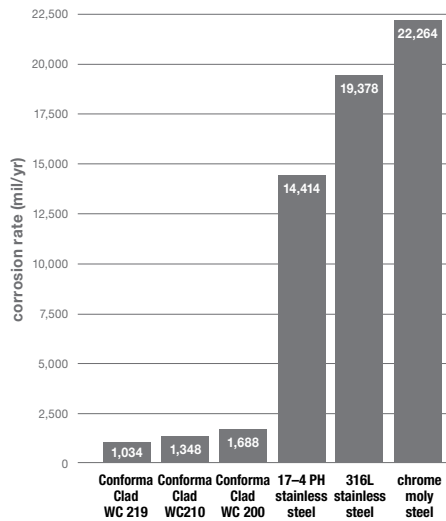
Performance Data

DRY SAND ABRASION TEST (ASTM G65)



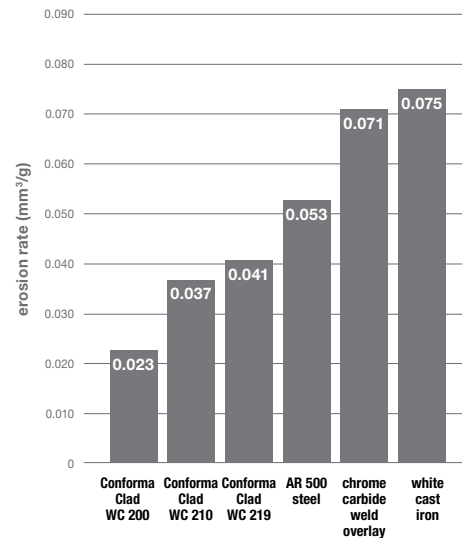
CORROSION TEST (ASTM G31)

10% Hydrochloric Acid at 212°F (100°C)



EROSION TEST (ASTM G76)

45° Impingement Angle, 83 m/s, Alumina <63 micron



UP TO 2.4X BETTER
 Abrasion Resistance versus Thermal Spray

UP TO 14X BETTER
 Corrosion Resistance versus Stainless Steel

UP TO 3X BETTER
 Erosion Resistance versus Chrome Carbide Weld Overlay

Cladding Properties

Properties	Kennametal	Thermal Spray	Weld Overlay	Wear Tiles	Plasma Spray
Bond Strength	Very High	Very Low	High	Low	Low
Complex Geometries	Yes	No	Difficult	Difficult	No
Abrasion Resistance	Very High	Moderate	High	Very High	Moderate
Erosion Resistance	Very High	Low to Moderate	Low	Low	Low
Corrosion Resistance	High	Low	Low	Low	Low
Impact Resistance	Moderate	Low	Moderate	Very Low	Low
Oxide Level	Low	High	Low	Low	High
Temperature Resistance	High	Moderate	Low	Very Low	Moderate
Resists Multiple Modes of Wear	Yes	No	Yes	No	No

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