HybriComp™ W611

Hybrid MATERIALS LLC

WC - 17%Co

HybriComp™'s are cermets fabricated into a hierarchical structure, developed with microstructures engineered at the nano-, micro- and meso-scale to offer revolutionary performance and cost breakthroughs. These materials are formed with a nanocomposite core and binder coating, which are made using a combination of low friction, high wear resistance and excellent corrosion resistant materials. The nano-composite core provides high wear resistance, low friction and light weight; and the binders provide corrosion resistance, toughness, ductility, resiliency, and improved deposition efficiency. This combination results in a high toughness, ductile-phased toughened structure of high hardness tiles separated by ductile binder laminates.

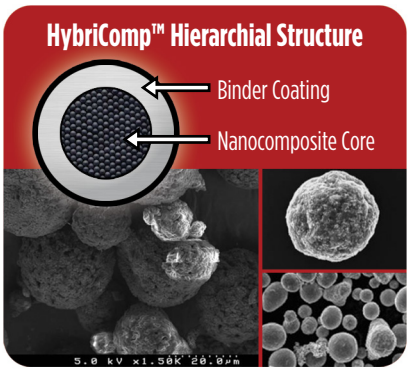
Typical Applications

Oilfield, Mining, Industrial, Automotive
- Low friction, high corrosion and wear resistance
- Half the cost of tungsten carbide

Mining, Oilfield, Industrial, Aerospace
- High toughness for extreme wear resistance
- Lowest life cycle cost solution

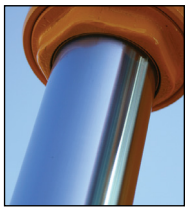
Galvanizing, Metal Processing
- High resistance to liquid/molten metal corrosion
- Lowest life cycle cost solution

Aerospace
- Low density, corrosion and spallation resistant
- 40% the weight of carbides



Near-Nano Composite Core
- High hardness and wear resistance
- Contains nano-dispersed friction modifiers
- Provides for fast machining

Binder Coating
- Improves adhesion and efficiency
- Provides toughness and resiliency
- Provides corrosion resistance
- Prevents compositional changes



HybriComp™ cermet coatings can replace electrolytic hard chrome, electroplating, spray and fuse and thermal spray carbides; to impart wear and corrosion resistance, and reduce friction in sliding wear applications. Cermet coatings are easy and fast to apply, and machine to tight tolerances for dimensional restoration of OEM or worn E&P components. The HybriComp™ family of coating materials has been designed to act as drop-in replacements for thermal spray powders and will work with today's existing application systems.

HybriComp Product Family

- **HybriComp™ T**
  Low friction, high corrosion and wear resistance
- **HybriComp™ W**
  High toughness, nano-composite carbide for extreme wear
- **HybriComp™ M**
  High resistance to liquid metal corrosion
- **HybriComp™ S**
  Low density, corrosion and spallation resistance

Value Proposition

Performance
- 3-20X+ extended life of components
- Unique: Provides both hardness and toughness
- Environmentally friendly

Cost
- Reduces downtime saving up to 10X the coating cost
- Significant capital cost savings due to reduced inventory needs
- Lowest life cycle cost solution

Time
- Higher spray efficiency, easier to grind and finish – saves approximately 30% in coating and finishing time
- Drop in replacement for current thermal spray powders

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Introduction

High toughness nano-engineered tungsten-carbide-cobalt (WC-Co) materials; have a high deposition efficiency (better yields, lower cost), and 5-7 times the ductility and toughness of conventional, micro-grain carbides. These materials are ideal for use in valve trim and seats on gate valves, sand erosion, and three body wear environments.

These powders are nano-structured ceramic-metal composites formed with a nanocomposite core and binder coating, utilizing a combination of high hardness, high wear resistance and excellent corrosion resistant materials. The nanocomposite core contains nano and near-nano size WC (Tungsten Carbide) particles in a hard, corrosion resistant binder. This core is encased in a protective cladding that minimizes the adverse effects of the HVOF straying process on the hard particles and helps form the coating's hierarchical structure. This combination results in a high-toughness, ductile-phased toughened structure of high hardness tiles separated by ductile binder laminates.

HybriComp™ W611 test results from our customers have shown 3-7 times the life in downhole applications over conventional materials, leading to the lowest coating life cycle cost in this segment.

Snapshot

Characteristic	Data
Classification	Tungsten-carbide cobalt
Chemistry	83WC-17Co
Manufacture	Sintered and crushed
Morphology	Spheroidal
Purpose	Abrasive wear resistance
Apparent Density	4.5 – 6.0 g/cm^3
Service Temperature	Up to 500 °C (930 °F)
Process	HVOF

Typical Applications

HybriComp™ W611 HVOF coatings replace electroplate hard chrome(EHC) and conventional WC –Co coatings in many industries including Oil & Gas downhole and pump components, mining, industrial, aerospace landing gear, etc. HybriComp™ W611 provides the ideal replacement for WC coatings, especially where additional wear resistance or ductility is required.

HybriComp™ W611 is an ideal replacement for Diamalloy 2005, Amdry 9831, Metco 5143, Woka 3202, Woka 3203, Amperit 526, Praxair LW-1N40 thermal spray powders, and offers longer-life at lowest life cycle cost compared to these thermal spray powders.

Material Information

Chemical Composition

	Weight Percent (Nominal)			
	W	Co	C (total)	Fe (max)
HybriComp W611	Bal.	16-18	4.5 - 5.5	0.3

Particle Size Distribution and Apparent Density

HVOF System	Nominal Range (µm)	Primary Carbide Grain Size	Apparent Density (g/cm^3)
DJ-5000	-38 + 10	200-400 nm	4.5 – 6.0
JP-5000	-45 + 15	200-400 nm	4.5 – 6.0

Coating Information

Key Thermal Spray Coating Information

Specification	Typical Data
Recommended Process	HVOF
Microhardness (HV0.3)	1200 - 1350
Wear Rate (ASTM G65 B)	Less than 2.5 mm^3
Porosity	Less than 1 %
Corrosion Resistance	No corrosion after 1000 hrs in salt fog test
Maximum Service Temperature	500 °C (930 °F)

Coating Parameter Sheets

Please contact us at sales@hybridmaterialsllc.com to receive coating parameters for HVOF and HVAF spray guns.

Safety and Handling

Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents prior to use to prevent segregation.
- Open containers should be stored in a drying oven to prevent moisture pickup.

Safety Recommendations

- Please contact us at sales@hybridmaterialsllc.com to receive the MSDS for this specific product for your country.

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