**PComP™ Thermal Spray Coating Materials**

PComP™ ceramic-metallic (cermet) thermal spray coatings replace electrolytic hard chrome, electroplating, spray and fuse, and thermal spray carbides by imparting supreme wear and corrosion at the lowest life cycle cost. PComP™ cermet coatings are easy and fast to apply, machine to tight tolerances for dimensional restoration of OEM or worn E&P components, and can be customized for both HVOF and HVAF thermal spray coating systems.

MesoCoat develops, manufactures, and sells PComP™ thermal spray coating materials that consist of cermets fabricated into a hierarchical structure, using a patented process to engineer down to the nano and micro-scale; and also offers turnkey thermal spray coating services. The result is a microcomposite cermet coating that offers revolutionary performance and cost breakthroughs. We are experts at developing coatings that extend the life of components, leading to significant reduction in downtime and maintenance losses, and risk of safety and failure.

PComP™ stands for Particulate Composite Powders. These materials are nano-structured ceramic-metal composites formed with a nanocomposite core and binder coating, which are made using combination of low friction, high wear resistance and excellent corrosion resistant materials. The nanocomposite core provides high wear resistance, 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.

**PComP™ Hierarchial Structure**

- 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

**PComP™ Thermal Spray Coating Services**

MesoCoat has a full-functional thermal spray coating facility with one large capacity spray booth, completed with a Fanuc robot, DJ 2600, DJ 2700 and JP 5000 HVOF spray systems, and is setting-up two additional thermal spray coating booths along with the associated surface preparation, component handling, and finishing equipment. Our staff has over 50 years of thermal spray experience coating parts for several industries including aerospace, chemical & plastics, oil & gas, mining, primary metals, industrial, and paper. MesoCoat has also partnered with several HVOF and HVAF thermal spray coating facilities that are pre-qualified with the largest OEM’s in the Gulf Coast, Midwest, and Canada providing MesoCoat the capability to undertake large orders for coating services.

**AWARDS**

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**PComP™ T**

**High Toughness, Corrosion-resistant Nano-structured Titanium Cermet**

PComP™ T uses a Titanium Nitride Cermet powder fabricated into a hierarchical structure using a patented process to engineer down to the nanoscale. The nanocomposite core contains nano and near-nano size TiN (Titanium Nitride) particles in a hard, corrosion resistant binder. This core is encased in a protective cladding that minimizes the adverse effects of the HVOF spraying process on the hard particles and assists in formation of a hierarchical coating structure and provides high wear resistance and light weight. This combination results in a high-toughness, ductile-phased toughened structure of high hardness tiles separated by ductile binder laminates. The result is a microcomposite cermet coating that offers revolutionary performance breakthroughs.

The chart below depicts the comparison of PComP™ T with the widely used competing solutions of thermally sprayed tungsten carbide (WC) and electroplated hard chrome. As can be seen in the chart below, PComP™ T outperforms the competing solutions in almost all of the seven critical parameters.

**PComP™ T45**

Nominal Chemistry (wt%): TiN - 42%, Ni - 7%, Cr

Higher toughness, corrosion-resistant nano-structured titanium cermet materials are highly resilient, machine quickly, have very low friction, and can replace chrome plating and carbides coatings in shaft, seal, plunger, and valve applications. PComP™ T45 can be machined with a standard grinding process, eliminating the need for the expensive diamond grinding process, with buildup rates 2-3 times that of carbides (reducing spray time up to 30%). High build rates and low stress attributes also allow the refurbishment of worn components.

PComP™ T45 coatings replace electroplate hard chrome (EHC) and a less expensive alternative to conventional WC coatings such as Sulzer-Metco Diamalloy®/Woka®, Praxair LW/SDG-2000 series coatings and Diamond-Like-Coatings (DLC) in many industries including automotive, industrial equipment, oil and gas down-hole and pump components; and also where EHC plating is being used but requires additional wear resistance and where DLC coating is being used but requires higher ductility.

**PComP™ MB05**

Corrosion- and wear-resistant nano-engineered metal-boride based cermets that also incorporate solid lubricants and surface tension modifiers to provide ultimate wear and corrosion resistance in metal processing applications for both new coatings and repair of existing components in applications like zinc pot (galvanizing) rolls, metal production (die casting, metal forming), metal processing equipment (casting, pumping, flow control) and metal forming equipment (stamping, forging).

The chart below depicts the performance of PComP™ M liquid metal corrosion coating solution with the currently used solutions. As can be seen in the chart PComP™ M coatings offer at least 6X extended life for coatings, and thus for the components used with liquid metals leading to significant reductions (-70%) in downtime costs.

**PComP™ M 144**

PComP™ M product is a self-lubricating nanocomposite material with high toughness, corrosion- and wear-resistant nanoengineered boride-based ternary and binary ceramic with an adjusted thermal expansion coefficient. This combination provides chemical stability, superior thermal shock resistance, extraordinary high-temperature molten-metal corrosion resistance, and solid lubrication in applications like zinc pot rolls, metal production, metal processing, metal forming, die casting, stamping, forging, etc.

**PComP™ MB 05**

PComP™ MB05 is a self-lubricated corrosion- and wear-resistant nanocomposite boride-based material that incorporates 5% nanodispersed solid lubricants. These coatings provide extreme protection in molten metal environment, and offer superior thermal shock resistance, high wear resistance, and low friction properties under low and high temperature conditions.
**PComP™ W**

**High toughness, nanocomposite carbide for extreme wear**

PComP™ W is a cermet powder fabricated into a hierarchical structure using a patented process to engineer down to the nanoscale. 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 spraying process on the hard particles and assists in formation of a hierarchical coating structure.

The chart below depicts the comparison of PComP™ W with the widely used competing solutions of thermally sprayed tungsten carbide (WC) and electroplated hard chrome. As can be seen in the chart below, PComP™ W outperforms the competing solutions in almost all of the six critical parameters.

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**Nominal Chemistry (wt%):** WC - 10%Co - 4%Cr

Premium high toughness nano-engineered tungsten carbide-cobalt-chrome materials; have high deposition efficiency, 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. PComP™ W104 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.

PComP™ W104 coatings replace electroplate hard chrome (EHC) and conventional WC-Co coatings such as Sulzer-Metco® Diamalloy® 2005 and Praxair LW-45® in many industries including aerospace landing gear, Oil & Gas downhole and pump components. These coatings have application where WC coatings are being used and additional wear resistance or ductility is required.

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**Nominal Chemistry (wt%):** WC - 13%Ni – 3%Cr – 3%Co

Premium high toughness nano-engineered tungsten carbide-nickel-chrome (WC-NiCr) materials; have high deposition efficiency and 5-7 times the ductility and toughness of conventional, micro-grain carbides. These materials are ideal for use in downhole and pump components and three “body wear environments”. Because of its high corrosion resistant matrix, PComP™ W333 is an excellent coating in harsh environments and has shown 3-7X life in downhole applications.

PComP™ W 333 coatings replace electroplate hard chrome (EHC) and conventional WC coatings such as Sulzer-Metco® Woka 3500 in many industries including chemical processing, oil and gas down-hole and pump components. These coatings have application where WC coatings and additional wear resistance or ductility is required.

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**Nominal Chemistry (wt%):** WC - 17%Co

Premium 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. PComP™ 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.

PComP™ W611 coatings replace electroplate hard chrome(EHC) and conventional WC –Co coatings such as Sulzer-Metco® 5847 , Stellite® JK-120 and Praxair LW-45® in many industries including aerospace landing gear, Oil & Gas downhole and pump components. These coatings have application where WC coatings and additional wear resistance or ductility is required.

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**Low density, corrosion and spallation resistant**

Lower density, spallation-resistant, nano-structured silicon base cermet material for wear and corrosion protection is an ideal replacement for the toxic chrome plating in aerospace and other weight critical applications. These materials have half the density of carbides, are similar in hardness, and offer better wear and corrosion protection. The lower density of these materials leads to substantial weight reductions in aircraft and automotive parts and other weight critical applications, leading to massive fuel savings.

The chart below depicts the comparison of PComP™ S with the widely used competing solutions of thermally sprayed tungsten carbide (WC) and electroplated hard chrome. As can be seen in the chart below, PComP™ S outperforms the competing solutions in almost all of the seven critical parameters.

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**Nominal Chemistry (wt%):** WC - 15%Ni – 3%Cr – 3%Co

Premium high toughness nano-engineered tungsten carbide-nickel-chrome (WC-NiCr) materials; have half the density of carbides, are similar in hardness, and offer better wear and corrosion protection. The lower density of these materials leads to substantial weight reductions in aircraft and automotive parts and other weight critical applications, leading to massive fuel savings. PComP™ S65 materials can be applied much thicker than alternative coating materials allowing the refurbishment and reuse of a large percentage of worn components, which would otherwise be scrapped creating a very large market opportunity.

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**Low density, corrosion and spallation resistant**

Lower density, spallation-resistant, nano-structured silicon base cermet material for wear and corrosion protection is an ideal replacement for the toxic chrome plating in aerospace, automotive, and other weight critical applications. These materials have half the density of carbides, are similar in hardness, and offer better wear and corrosion protection. The lower density of these materials leads to substantial weight reductions in aircraft parts and other weight critical applications, leading to massive fuel savings. PComP™ S65 materials can be applied much thicker than alternative coating materials allowing the refurbishment and reuse of a large percentage of worn components, which would otherwise be scrapped creating a very large market opportunity.
**PComP™ Thermal Spray Coating Products Snapshot**

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<th>Product</th>
<th>Description</th>
<th>Commercial Stage</th>
<th>Industry and Value Proposition</th>
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<tr>
<td>PComP™ W</td>
<td>High toughness, nanocomposite carbide for extreme wear</td>
<td>Commercial Sales since 2012</td>
<td>Mining, Oilfield, Industrial, Aerospace</td>
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<td></td>
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<td></td>
<td>- Up to 80X extended life in sliding wear applications</td>
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<td>- Lowest life cycle cost solution</td>
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<tr>
<td>PComP™ T</td>
<td>Low friction, high corrosion and wear resistance</td>
<td>Commercial Sales since 2014</td>
<td>Oilfield, Mining, Industrial, Automotive</td>
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<td>- 3-15X extended life</td>
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<td>- Half the cost of tungsten carbide</td>
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<tr>
<td>PComP™ M</td>
<td>High resistance to liquid metal corrosion</td>
<td>Field Testing</td>
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<td></td>
<td></td>
<td>- 6-10X extended life</td>
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<td></td>
<td>- Lowest life cycle cost solution</td>
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<tr>
<td>PComP™ S</td>
<td>Low density, corrosion and spallation resistant</td>
<td>Final stage of qualification</td>
<td>Aerospace</td>
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<td></td>
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<td>- 2-6X extended life</td>
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<td>- 40% the weight of carbides</td>
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**PComP™ Value Proposition**

PComP™ is a platform technology that allows combining a variety of materials, which do not usually bond well, in a structured fashion to develop coating materials that offer the desired properties and performance. PComP™ is the only coating material that produces coatings that are both hard and tough, a feat considered near impossible with the conventional thermal spray coatings. Additionally, better corrosion and wear resistance leading to longer life, lower density which enables coating higher amount of surface area, higher spray and grinding efficiency that enable higher productivity, and compatibility with existing HVOF and HVAF coating systems offer PComP™ an arsenal of market advantages that are difficult for competitors to match.

Imagine advanced coating materials that are put through the toughest abuse and still come out shining, coatings that are not just good for one application but can withstand severe wear, corrosion and thermal conditions in a variety of applications. Imagine coatings that make the impossible - possible, coatings that increase the life of components by 3-20 times and yet are cheaper, lighter, and save us from the use of toxic materials regulated by OSHA and other environmental bodies.

**Performance**
- 3-80X extended life of components
- Up to 100X lower system wear
- 4-10X toughness/ductility of standard carbide coatings – improves life, reduces risk of infant mortality (spallation)
- Unique: Provides both hardness and toughness
- Environmentally friendly

**Cost**
- Significantly reduces downtime and maintenance costs @ $100,000/hour
- Massive cost savings due to reduced inventory needs
- Up to 50% cheaper than current solutions
- Lowest life cycle cost solution

**Time**
- Lower Density product, improves spray cell productivity by 2-3X
- 3-5X grinding efficiency, lowers cost and improves grinding cell productivity by 3-5X, eliminates burning of high strength steels
- Higher spray efficiency, easier to grind and finish – saves approximately 30% time
- Drop in replacement for current thermal spray powders