metco
joining & cladding

Product Data Sheet
Martensitic Matrix Hardfacing Alloy with Extremely Hard Tungsten Borides and Niobium Carbides

Powder Products: Metco 1051A

U.S. and international patent protected

1 Introduction
Metco™ 1051A is specifically designed to perform in aggressive environments where both abrasive wear and impact are of concern. Deposits of these products are unique in that they exhibit impact resistance that is 10 to 20 times better than PTA-applied WC-Ni overlays, but with similar abrasion resistance.

Unlike typical PTA-applied WC-Ni deposits, the carbides and borides in Metco 1051A is thermodynamically grown in the liquid alloy and thus are always consistent in size, shape and distribution. This fine-scale microstructure has many beneficial effects such as preventing small sand particles from attacking the matrix directly and even distribution of thermal stresses upon cooling.

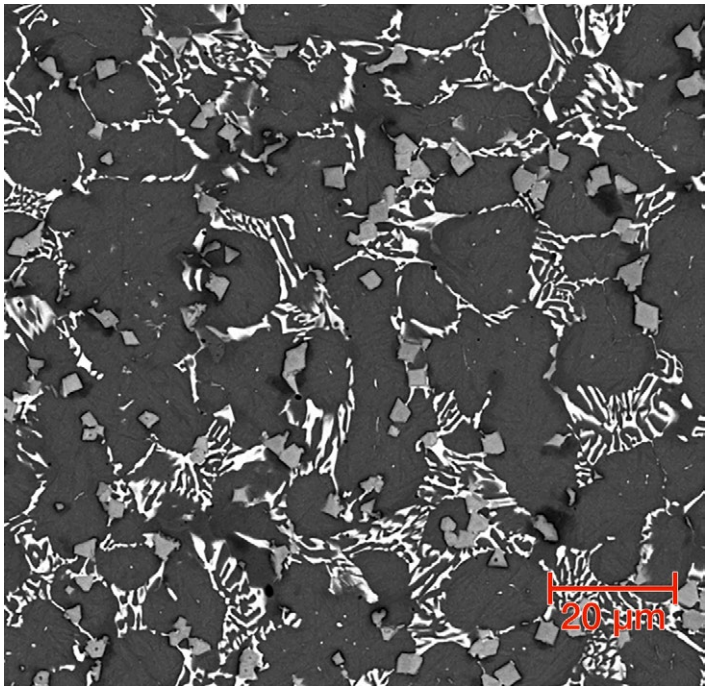
However, the most important benefit of Metco 1051A coatings is their ability to withstand impact and high stresses. Almost every application that is commonly understood to be an abrasive environment is also an environment containing high stress and significant levels of impact.

1.1 Typical Uses and Applications
Metco 1051A is suggested for use in any application where abrasion resistance is required. The unique performance is particularly well suited for agricultural applications where sharp cutting surfaces are desired.

Specific applications include:
- Shaker screens
- Chippers
- Pipe ID surfaces
- Chute and heel blocks
- Primary and secondary crusher teeth
- Ground engaging tools for mining applications
- Other mining applications
- Harvester blades and disks
- Sugar hammers
- Disk harrows
- Agricultural shear bars
- Ground engaging tools for agricultural applications

Quick Facts

Classification	Alloy, iron-based
Chemistry	Proprietary Martensitic alloy
Manufacture	Gas atomized
Abrasion Resistance	0.08 to 0.12 g lost (ASTM G65A low stress abrasion)
Jaw Crusher Test	0.217 g lost (high stress abrasion)
Impact Resistance	> 6 000 (powder); > 10 000 (wire) impacts @ 20 J without failure
Overlay Hardness	60 to 65 HRC
Hard Phase	≈ 20%
Purpose	Impact and abrasion resistance
Processes	PTA, Laser Cladding



Typical as-welded coating microstructure of Metco 1051A

2 Material Information

2.1 Physical Properties and Characteristics

Product	Nominal Chemistry	Product Form	Size	Recommended Process	Previously Sold As
Metco 1051A	Proprietary	Powder	-150 +53 µm	PTA, Laser Cladding	Vecalloy 700

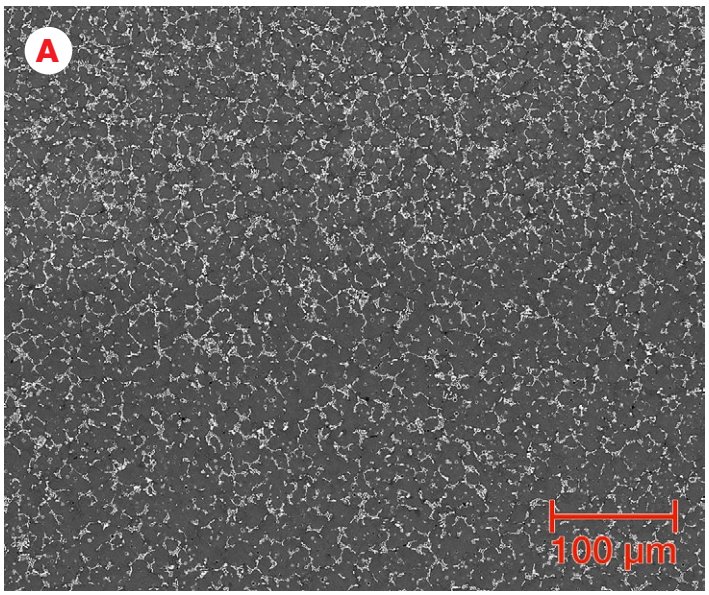
2.2 Key Selection Criteria

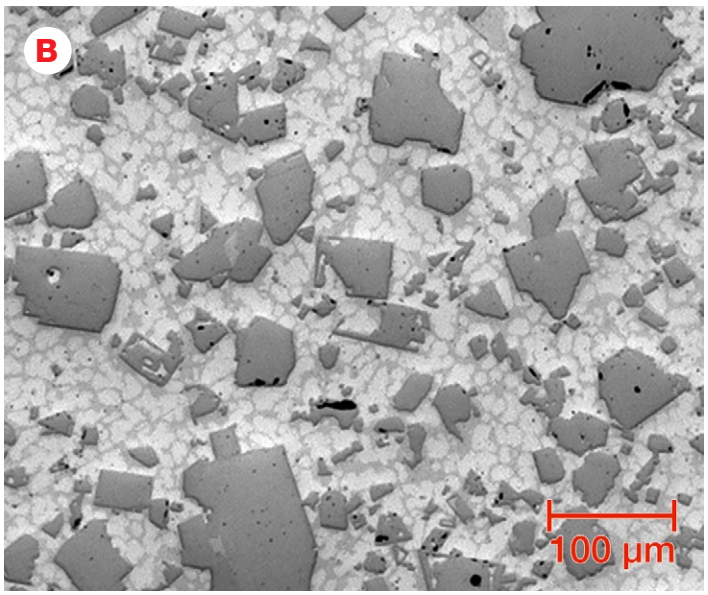
- **Fine-Scale Microstructure:** The carbides and borides in deposits of Metco 1051A ranges in size from 1 to 10 µm. Computational metallurgy allows us to design these phases to grow thermodynamically from the liquid phase at a small and consistent size, shape and distribution. Furthermore, the complex boride and carbide particles are embedded in a hard, martensitic matrix. The result is a deposit that is consistent from the interface of the deposit and the substrate to the surface of the deposit.

- **Homogeneity:** Metco 1051A is deposited as a single alloy that naturally grows a network of fine-scaled carbide and boride precipitates. The deposits are thermodynamically driven to form a carbide and boride network in equal concentrations throughout the weld thickness.

- **Lasting Wear Protection:** Deposits of Metco 1051A provide long-lasting abrasion protection in actual applications. The reason lies in the revolutionary improvement in impact resistance. Relatively low levels of impact on other hard face deposits can generate cracks within the deposit and exasperate material loss as a result of cracking aggravated by abrasion. Coatings of Metco 1051A a have as much as 10 to 20 times the impact and crack resistance of other hard face solutions.

- **Application Examples:** The following application example demonstrates how Metco 1051A is effectively utilized in abrasive environments with impact to improve component service life and reduce costs:
  - **Shaker Screens:** Deposits outlast WC-Ni in side-by-side trials by 3-fold.
  - **Ground Engaging Tools (GET):** Deposits result in 70 % to 200 % increase in GET lifetimes in hard rock mines where conventional chromium carbide and tungsten carbide solutions spall off and are ineffective.
  - **Heel Blocks:** Deposits have 1/10th the wear rate of conventional solutions.
  - **Primary and Secondary Crusher Teeth:** Deposits result in lifetime increases of up to 4-fold versus conventional carbide and WC-Ni overlays in comparative trials.
  - **Chippers:** Deposits outlast WC-Ni overlays by 2-fold.





Microstructure comparison of Metco 1051A laser clad deposit **[A]** versus WC-Ni GMAW deposit **[B]**. Note the carbide spacing is thermodynamically driven to a very precise spacing and fine hard phase size in the Metco 1051A laser clad deposit versus the very large hard phase particles in the WC-Ni GMAW deposit.

2.3 Related Products

- When better abrasion resistance is required for PTA or laser clad deposits, consider Metco1030A or Metco 1030B. These materials are chromium free and offer excellent abrasion resistance and very good impact resistance, but impact resistance will not be as high, nor atmospheric corrosion resistance as good, as deposits of Metco 1051A.

- If yet higher gouging and wear resistance is still needed, Metco 51059A, applied using PTA or laser cladding, can be used. It produces a microstructure with a higher volume fraction of larger carbides.

- When better abrasion resistance is required for wire welding processes such as GMAW or open arc welding, Metco 8224 or Metco 8226 is recommended. Metco 8224 also delivers the very high impact resistance, while Metco 8226 produces a uniquely high level of hard phases typically useful for gouging abrasion applications.

- When improved impact resistance is required for wire welding processes, Metco 8233 is recommended (available as 2.8mm wire).

- When wire welding onto 300 series stainless steel or Mn steel, Metco 8250 is recommended.

- Metco 1040x series materials can be considered when non-magnetic or a more corrosion-resistant material is needed. Metco 1040x series materials are excellent candidates for wear applications on components used for directional drilling.

Metco Joining & Cladding offers a wide range of other products designed for mining applications. Products are available in wire and powder form appropriate for application using thermal spray, PTA, laser cladding and other welding processes. Please contact your Metco Joining & Cladding Account Manager for more information.

3 Key Coating Information

3.1 Using Metco 1051A

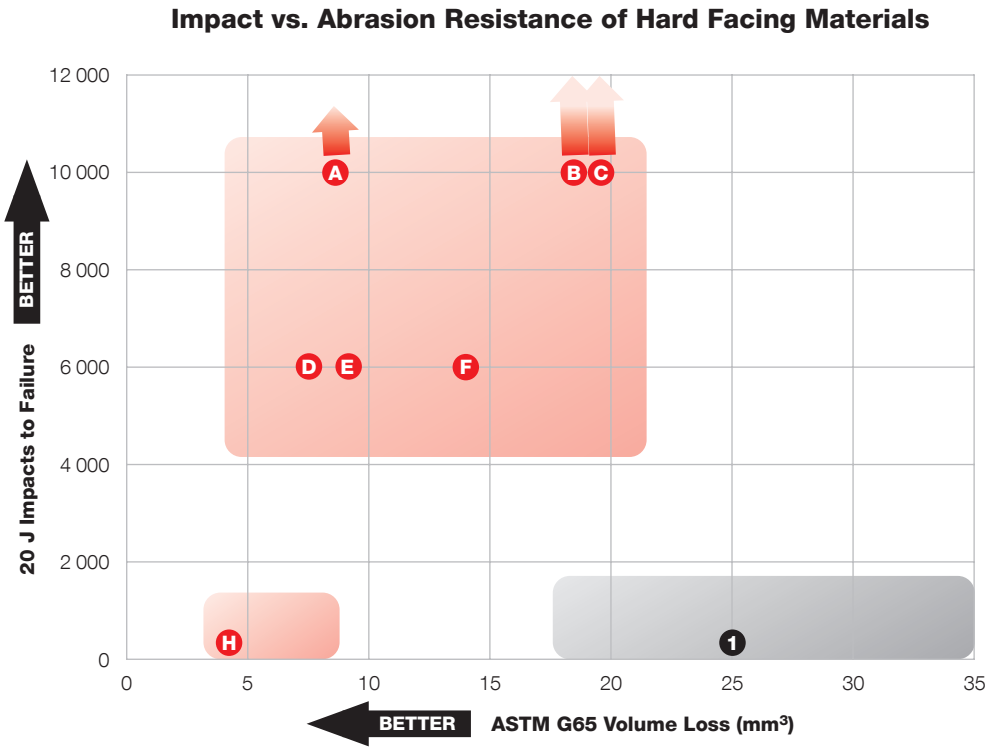
Plasma Transferred Arc (PTA) Parameters

Powder size	-150 +53 µm
Voltage	27 to 32 V
Amperage	140 to 170 A
Expected thickness (approx.)	≈ 2 to 5 mm (0.08 to 0.20 in)
Expected hardness (approx.)	62 to 65 HRC
Expected ASTM G65A	0.08 to 0.12 g loss

Please note that parameters can vary significantly with different PTA equipment and these parameters can only serve as a starting point. PTA welds can be deposited with multiple layers to achieve the desired total thickness.

3.3 Coating Development

For specific coating application requirements, the services of Metco Joining & Cladding's Coating Solution Centers are available. Please contact your Metco Joining & Cladding Account Manager for more information.



A Metco 8224
GMAW, OA
Cr-free, heat treatable

B Metco 1040A
PTA, Laser Cladding
Mn steel compatible,
non-cracking, non magnetic

C Metco 8233
OA, SAW
Mn-steel compatible
non-magnetic

D Metco 1030A
PTA, Laser Cladding
Cr-free, heat treatable

E Metco 8226
GMAW
gouging resistant

F Metco 1051A
PTA, Laser Cladding

G PlasmaDur 51027
PTA, 60/40 WC-Ni

1 Chromium Carbides (CCO)
GMAW. OA, SAW

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Form	Size	Package Size	Availability	Distribution
Metco 1051A	1300511	Powder	-150 +53 µm	10 lb (4.5 kg)	Stock	Global

4.2 Handling Recommendations

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

4.3 Safety Recommendations

See SDS 50-2203 (Safety Data Sheet) in the localized version applicable to the country where the material will be used. SDS are available from the Metco Joining & Cladding web site at www.metcojoiningcladding.com (Resources – Safety Data Sheets).

Product	SDS Index No.
Metco 1051A	50-2203
Metco 8248 (1.6 mm)	50-2473
Metco 8248 (2.8 mm)	50-2472

The Metco Joining & Cladding Difference:

Metco 1051A and Metco 8248 were developed using our patented and proprietary **Scoperta™** high throughput computational metallurgical process to evaluate millions of candidate alloy compositions. Potential candidates are then experimentally evaluated using an advanced screening process where both properties and alloy microstructure are measured.

The combined **Scoperta** computational and experimental approach allows Metco Joining & Cladding to rapidly design the final material with a much better accuracy than conventional empirically-based methodologies.

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