

# Product Data Sheet

## Martensitic Hardfacing Alloy with Fine-Scale Borides

### Powder Products: Metco 1001A

Patent pending

#### 1 Introduction

Metco™ 1001A is a limited sale product restricted to Oerlikon Metco qualified users on a geographic, contractual basis.

Metco 1001A is a revolutionary new iron based hardfacing material specifically designed to provide extreme wear and impact resistance for bulk-welded wear plate applications in conjunction with a solid iron wire. It provides the best performance in aggressive environments where impact and abrasive wear are critical sources of material failure. It is not designed use for use in other processes.

In terms of wear resistance, the high density of complex borides in a tough martensitic matrix allows deposits of Metco 1001A to compete with the wear performance of WC-Ni overlays at a lower price point. The extremely fine lamellar structure of the complex borides allows for impact performance that is as much as 4 times that of both chromium carbide overlays (CCO) and nanostructured forming steels.

#### 1.1 Typical Uses and Applications

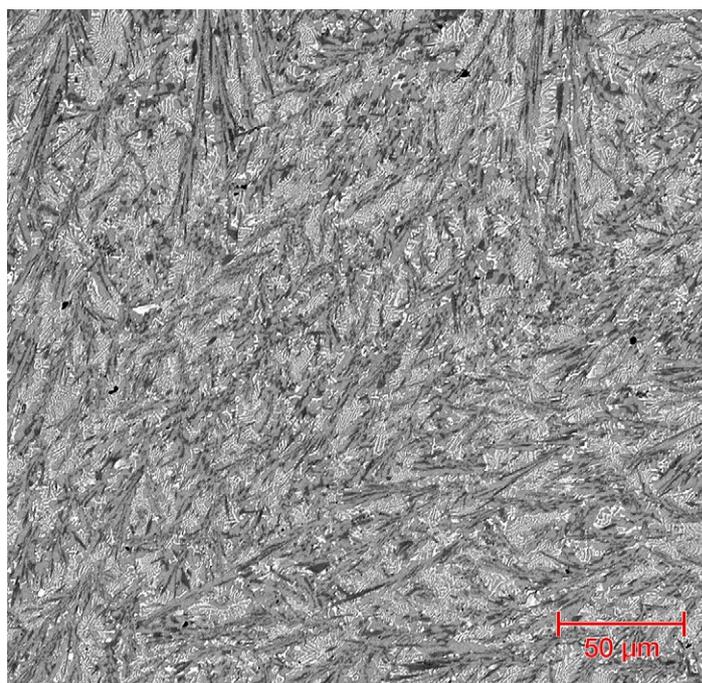
Wear plates coated with Metco 1001A are suggested for use in any application where abrasion resistance is required. The revolutionary improvement in impact resistance and toughness will typically result in an extended lifetime over PTA-applied WC deposits and chromium carbide coatings.

Specific applications include:

- Shaker screens
- Grader blades
- Chute blocks
- Wear plates
- Mill liners
- Slurry pipes
- Shovel wear packages
- Communiton
- Other mining applications

### Quick Facts

Classification	Alloy, iron-based
Chemistry	Proprietary
Manufacture	Blend
Abrasion Resistance	0.1 to 0.16 g lost (ASTM G65A low stress abrasion)
Impact Resistance	> 2 500 impacts @ 20 J without failure
Macrohardness	65 to 69 HRC
Boride Fraction	40 to 45 vol. %
Purpose	Impact and abrasive wear resistance
Processes	Bulk powder welding



Typical as deposited microstructure from wear plate produced with 1001A

## 2 Material Information

### 2.1 Physical Properties and Characteristics

Product	Nominal Chemistry	Product Form	Recommended Process
Metco 1001A	Proprietary	Powder	Bulk powder welding

### 2.2 Key Selection Criteria

#### ■ Performance versus Conventional Hardfacing

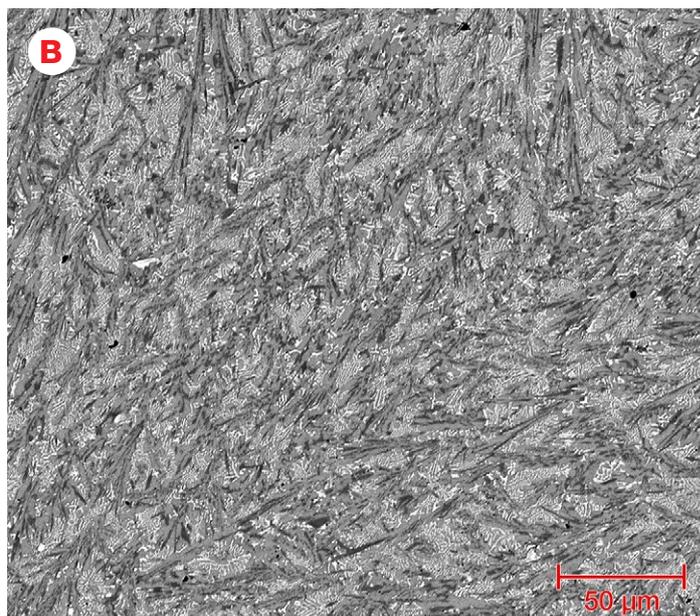
**Materials:** Wear plate overlays of Metco 1001A uniquely pair the toughness required for high impact applications with high wear resistance to rival other hardfacing materials. It achieves these typically discordant properties by forming a high fraction of tough, lamellar complex borides while avoiding long needle-like particles indicative of problematic embrittlement in chromium carbide overlays and many nanostructured steel alloys.

■ **Homogeneity:** Overlays of Metco 1001A are deposited as a single alloy with carbides and borides thermodynamically driven to precipitate homogeneously throughout the weld thickness. Overlays of Metco 1001A outperform chromium overlays in abrasion and impact resistance. They outperform WC-Ni PTA-applied overlays in impact resistance in applications where corrosion is not a major concern.

■ **Fine-Scale Microstructure:** WC-Ni PTA and chromium carbide coatings contain carbide particles of the order of 50 to 250  $\mu\text{m}$  in size. In contrast, the borides in deposits of Metco 1001A range in size from 1 to 10  $\mu\text{m}$ .

Computational metallurgy allows us to design these phases to grow from the liquid at a small and consistent size, shape and distribution. This fine-scale microstructure has many beneficial effects such as preventing small sand particles from attacking the matrix directly and distributing thermal stresses more evenly upon cooling. However, perhaps the most important benefit of the microstructure exhibited by Metco 1001A overlays is the ability to withstand impact and high stresses. Almost every application which is commonly understood to be an abrasive environment is also an environment containing high stress and significant levels of impact. Metco 1001A overlays provide the best performance of any hardfacing in high impact, high abrasion applications.

■ **Matrix Hardness:** High stress gouging, which occurs in many applications such as ground engaging tools, is capable of deforming a soft matrix and essentially machining away any carbide particles. Overlays of Metco 1001A, are engineered to form a hard martensitic matrix that is highly resistant to this form of damage resulting in long service life for the overlay.



in micrograph [A] of a typical chromium carbide overlay on a wear plate, the  $\text{M}_7\text{C}_3$  carbides form an embrittling hypereutectic — a "needle-like" morphology that hinders impact resistance and wear performance due to fine particles. In micrograph [B] of a typical Metco 1001A wear plate overlay, the fine boride spacing provides improved impact and fine particle abrasion resistance.

## 2.3 Related Products

- Customers should consider Metco 1018A as the preferred material of choice for wear plate applications. However, in some instances customers may find that Metco 1001A gives better results for their bulk welding equipment.
- For even better abrasion resistance when applying an overlay using PTA, consider Metco 1030A. For excellent impact resistance, consider Metco 1051A or Metco 1040A. If yet higher gouging and wear resistance is still needed, WOKA 53003, applied using PTA or laser cladding, can be used. It produces a microstructure with a higher volume fraction of larger carbides.
- For open arc welding (BMAW), consider using Metco 8224, Metco 8226 or Metco 8233. Metco 8226 offers high abrasion resistance, Metco 8233 offers high impact resistance and Metco 8224 offers a combination of good abrasion and impact resistance.
- Oerlikon Metco produces 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 Oerlikon Metco Account Manager for more information.

## 3 Key Coating Information

### 3.1 Coating Development

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

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Form	Size	Package Size	Availability	Distribution
Metco 1001A	1303702	Powder	-150 +53 $\mu$ m	225 kg (approx 496 lb) drum	Special Order	Global

Note: Ordering restrictions apply

### 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 50-2305 (Safety Data Sheet) in the localized version applicable to the country where the material will be used. SDS are available from the Oerlikon web site at [www.oerlikon.com/metco](http://www.oerlikon.com/metco) (Resources – Safety Data Sheets).

### **The Oerlikon Metco Difference:**

Metco 1001A was 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 Oerlikon Metco to rapidly design the final material with a much better accuracy than conventional empirically-based methodologies.