

# WEARTECH® SHS™ 9172HV

Severe Abrasion, Thermal Spray Powder

## Application Process

High Velocity Oxy-Fuel  
Thermal Spraying (THSP-HVOF)

## Material Chemistry (wt%)

Chromium	< 25%
Tungsten	< 15%
Niobium	< 12%
Molybdenum	< 6%
Boron	< 5%
Carbon	< 4%
Manganese	< 3%
Silicon	< 2%
Iron	Balance

## Microhardness (HVO .3)

1000 - 1100 kg/mm<sup>2</sup> typical

## Wear Resistance

ASTM G65-04 Procedure B  
Typical mass loss 0.07 g

## Bond Strength

ASTM C633-01  
10 ksi (69 MPa)

## Coating Properties

Density (g/cm<sup>3</sup>) 7.59  
Porosity/Oxides < 5%

## Impact Resistance

Drop Impact Testing:  
No delamination/cracking  
at 480 in-lbs

## Coating Description

SHS9172HV is an iron based steel alloy which features exceptional resistance to abrasion, corrosion resistance, erosion, impact and high temperature oxidation.

## Key Performance Characteristics

- Excels in high sulfur and elevated temperature environments where fly-ash and bed-ash erosion occurs
- Exceptional abrasion resistance for a metallic material
- Significant corrosion and high temperature oxidation resistance
- Very high bond strength across a range of substrate materials, including aluminum, copper, carbon steel and stainless steel
- Can be finished to very high surface specifications as a replacement for hard chrome
- Hardness and corrosion and wear resistance is superior to hard chrome

SHS9172HV coatings feature exceptional resistance to abrasion and a significant ability to withstand corrosion and high temperature oxidation. SHS9172HV is especially resistant to elevated temperature sulfidation attack and is widely used for elevated temperature erosion and corrosion protection of heat exchange tubes in coal fired boilers. As a replacement for hard chrome, SHS9172HV provides improved resistance to mechanical damage and can be polished to a very high surface finish. While conventional corrosion resistant materials are relatively soft, SHS9172HV in the as-sprayed condition provides hardness and wear resistance equivalent to hard chrome. SHS9172HV has excellent damage tolerance applicable to harsh service environments in a wide range of industrial applications. Additionally, the extremely fine microstructure of SHS9172HV improves toughness, ductility and fatigue resistance.

## Resistance to Abrasion and Erosion

SHS9172HV is a glass-forming steel alloy formulated with high concentrations of transition metals which readily dissolve in the glass structure. When applied using benchmark thermal spray parameters, an amorphous matrix is formed which contains hard complex nanoscale borocarbide precipitates. When compared to existing competitive coatings, the microstructures formed in the as-sprayed or fully devitrified (heat treated after spraying) state provide superior resistance to abrasive wear and fine particle erosion.

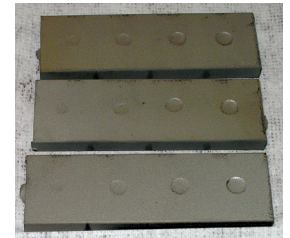
## Damage Tolerance

SHS9172HV coatings feature superior toughness and resiliency. Impact testing was done using a Gardner drop impact testing machine at impact energies of 120, 240, 360 and 480 in-lbs. As-sprayed SHS9172HV coating samples withstood impacts of up to 480 in-lbs without cracking, chipping or delaminating, while demonstrating the ability to deform with the substrate. Additionally, the specific high-transition metal chemistry (chromium, molybdenum, tungsten and niobium) of SHS9172HV provides excellent corrosion resistance. The ability to withstand high impact and resist extreme abrasion and corrosion makes SHS9172HV an excellent hard chrome alternative.

## Industrial Uses

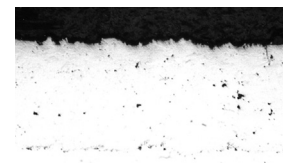
Power Generation

## Impact Testing



As-sprayed SHS9172HV coatings demonstrate the ability to deform with the substrate without cracking, chipping or delaminating

## Coating Microstructure



Optical micrograph at 100x of a typical SHS9172HV coating taken at 100x

### CUSTOMER ASSISTANCE POLICY

The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to [www.lincolnelectric.com](http://www.lincolnelectric.com) for any updated information.