WEARTECH® SHS™9700P

Severe Abrasion, (PAW) Weld Powder

Application Process

PAW Powder for
Weld Overlay for Hardfacing

Material Chemistry (wt%)

Chromium	< 21%
Boron	< 7%
Niobium	< 6%
Molybdenum	<6%
Aluminum	< 5%
Carbon	< 2%
Manganese	< 2%
Silicon	< 2%
Iron	Balance
Molybdenum	<6%
Aluminum	< 5%

Rockwell C (HRC) Hardness

67 - 69 HRC

Wear Resistance

ASTM G65-04 Procedure A

Typical mass loss	0.13g

Weld Deposit Properties

Density (g/cm^3)	7.36
Deposition Efficiency	80 - 85%

Impact Resistance

Drop Impact Testing:
Passed multiple impacts at 165 ft•lbs

Overlay Description

SHS9700P is an iron based steel alloy with a near nanoscale (submicron) microstructure that features good abrasion and fine particle erosion resistance with no high-cost nickel, tungsten and molybdenum in the material chemistry.

Key Performance Characteristics

- 67 - 69 HRC single and double pass weld deposits
- Economical iron-based alternative to nickel based materials containing tungsten carbide
- Good resistance to abrasion and erosion from fine particles
- Highly refined microstructure

SHS9700P is an iron-based alloy for PAW hardfacing and wear protection applications that has been designed to be free of high-cost strategic elements such as nickel, tungsten and molybdenum. SHS9700P is an alternative to nickel based PAW alloys with up to 40% tungsten carbide for use in moderate to high wear applications. SHS9700P allows high undercooling to be achieved during welding, resulting in considerable refinement of the microstructure down to a near nanosize (submicron) range. Unlike conventional weld overlay materials which are macrocomposites that contain hard particles and general carbides in a binder, the refined microstructure of SHS9700P does not incorporate distinct hard particles in a binder and is a uniformly hard matrix when welded. This allows SHS9700P to provide vastly improved hardness/wear resistance and last significantly longer than conventional macrocomposites.

High Hardness

SHS9700P will exhibit higher hardness when applied in multiple layers. The micrograph image to the right shows how 68 HRC hardness develops within microns of the weld overlay interface. HRC hardness data points in the micrograph were measured from a single pass SHS9700P weld overlay applied to A36 steel plate.

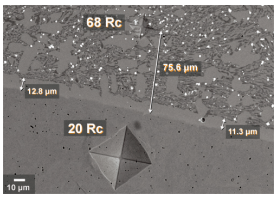
Extreme Abrasion/Erosion Resistance

SHS9700P can be built up in as many weld passes as necessary with the second and all subsequent layers providing maximum wear resistance of typical mass loss of 0.13g in ASTM G65-04 Abrasion Wear Tests.

Industrial Uses

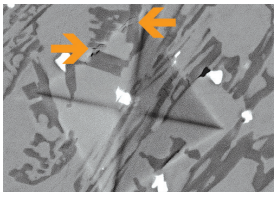
Mining

HRC Hardness



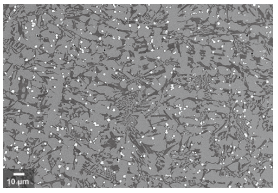
SEM image of weld interface

Superior Toughness



SEM image of Vickers indentation shoes cracks are quickly blunted and stopped by the ductile matrix

Microstructure



SHS9700P microstructure is refined to a near nanosize (submicron) range

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Damage Tolerance

The superior toughness of SHS9700P occurs from the in situ formation of high volume fraction of refined complex borocarbide phases during welding which are surrounded by ductile phases. The borocarbide phases, which form during solidification, are completely wetted by the matrix and prevent premature pull-out, delamination and crack nucleation. The refined nature of the borocarbide phases allows the reduction of stress concentration sites and the ductile matrix supplies effective crack blunting and bridging.

The Lincoln Electric Company

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WEARTECH® SHS® 9700P

Severe Abrasion

KEY FEATURES

- Economical iron-based alternative to nickel based materials containing tungsten carbide
- Good resistance to abrasion and erosion from fine particles
- Highly refined microstructure

TYPICAL APPLICATIONS

- Wearplate
- Crusher Rolls
- Ore Chutes
- Screw Augers

Size Micron (µm)	10 lb (4.5 kg) Bottle
+53/-180	P9700-53/180 (ED035724*)

** EDO numbers have been discontinued and replaced by the Weartech part numbers for the cross selling program.*

MECHANICAL PROPERTIES(1)

Rockwell Hardness (R_C)	Wear Resistance
67-69	ASTM G65-04 Procedure A 0.13 g mass loss

DEPOSIT COMPOSITION(1)

%Fe	%C	%Cr	%B	%Nb	%Mn	%Si
Balance	<2	<21	<7	<6	<2	<2

TYPICAL OPERATING PROCEDURES

Current (Amps)	Voltage (Volts)	Powder Feed Rate lb/hr (g/min)	Shielding Gas	Flow Rate (cfh)	Plasma Gas
180	22	3.3-3.9 (25-29)	95 Ar – 5 H_2	25	100% Ar
Oscillation in (mm)	**Oscillation Rate (hz)**	**Dwell Time (s)**	**Slew Time (s)**	**Travel Speed in/min (mm/min)**	
0.6 (15)	1	0.1	0.4	3.5 (89)	

** This procedure was developed on a Eutectic GAP 375 power source and a Eutectic GAP E52 torch. Changes in equipment, materials, and substrates may change optimum procedures. Listed procedures should only be used as a starting point.*

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume.

BEFORE USE, READ AND UNDERSTAND THE SAFETY DATA SHEET (SDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

Material Safety Data Sheets (MSDS) and Certificates of Conformance are available on our website at www.lincolnelectric.com

TEST RESULTS

Test results for mechanical properties, deposit or electrode composition and diffusible hydrogen levels were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

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.

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Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

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