SURPREX W1004

FUJIMI INCORPORATED
Technical Bulletin

WC/10%Co/4%Cr

SURPREX W1004 series are WC/10%Co/4%Cr powder materials for thermal spraying. The particle size and strength are strictly controlled, during agglomerating and sintering processes, to avoid spitting during spraying. Excellent corrosion resistance is exhibited in both dry and wet environments with a great deal of improvements made on poor corrosion resistant WC/Co-type cermets. Well-balanced sprayed coatings can be produced by a combination of high hardness, wear resistance and toughness.

1. Types

Four types are available in the SURPREX W1004 range to suit different spray guns.

Type	Particle Size (μm)	Spray Gun
SURPREX W1004L	-53+15	JP-5000, JPW5, J gun, DJ2600, DJ2700, Axial III, High power plasma gun, etc.
SURPREX W1004J	-45+15	JP-5000, JPW5, J gun, HVAF, Jet Kote, DJ2600, DJ2700, Axial III, Ordinary plasma gun, etc.
SURPREX W1004D	-38+10	DJ standard, HVAF, Jet Kote, Ordinary plasma gun, etc.
SURPREX W1004S	-30+5	SB-250, SB-500, θ gun, etc.

2. Properties

Typical Chemical Composition

wt.%

Type \ Element	W	Co	Cr	C	Fe
SURPREX W1004J	Bal.	10.0	4.0	5.9	0.1

Typical Particle Size Distribution

Cumulative wt.%

Type \ Size	+53 μm	+45 μm	+38 μm	+32 μm	-20 μm	-15 μm
SURPREX W1004J	0.2	5.6	18.0	28.4	13.2	2.6

Typical Apparent Density and Flow Rate

Type \ Property	Apparent Density (g/cm^3)	Flow Rate (sec/50g)
SURPREX W1004J	5.2	15.7

3. Coating Characteristics and Applications

①Characteristics
- Corrosion resistance
- Wear resistance
- High toughness
- Acid resistance

②Applications
- Turbine blades
- Hydro-turbine blades
- Pump parts
- Film rolls
- Paper manufacturing coating rolls
- Printing machinery parts
- Plungers

4. Data on Coating Characteristics

W1004J is compared with major WC cermets of WC/20%CrC/7%Ni and WC/12%Co for the coatings sprayed on JP-5000, a popular HVOF gun.

Spray Conditions on JP-5000

Condition / Spray Material	Oxygen (l/min)	Kerosene (l/min)	Spray Distance (mm)	Barrel Length (inches)
WC/20CrC/7Ni	893	0.35	380	8
WC/12Co	893	0.32	380	8
SURPREX W1004J	870	0.38	380	8

Included in the data below are characteristics of flame sprayed and fused coatings of Ni-based self-fluxing alloy (Ni-16%Cr-4%Si-4%B-3%Cu-3%Mo-2.5%Fe-0.5%C, referred to as 16C) and WC/12%Co blended with Ni-based self-fluxing alloy ((WC/12%Co)-33%Ni-9%Cr-3.5%Fe-2%Si-2%B-0.5%C, referred to as 34F).

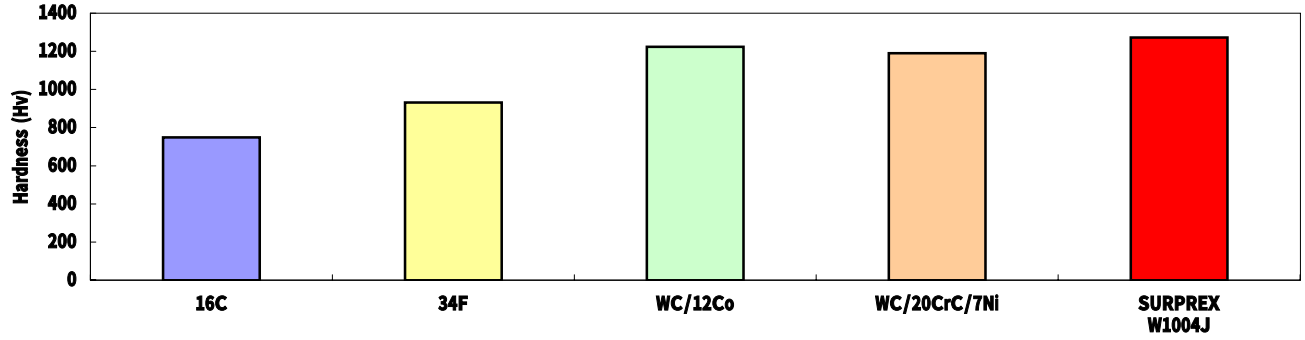


Fig.1 Coating Hardness

WC-type cermet coatings sprayed on JP-5000 achieved higher hardness ranging from Hv (200g) = 1190 to 1270, while 34F and 16C show approx. 950 and approx. 750, respectively.

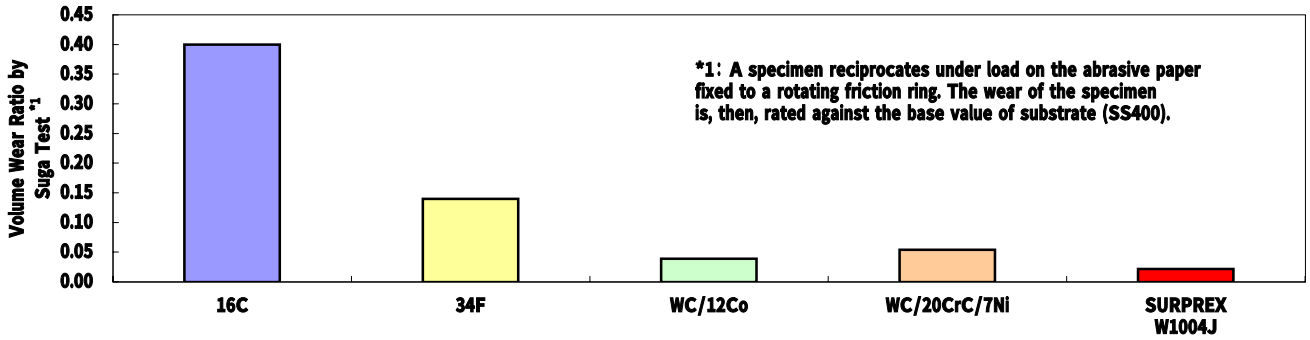


Fig.2 Dry Abrasive Wear Test

For dry abrasive wear resistance (Suga-method), cermet coatings demonstrate excellent quality compared with 16C. W1004J shows approx. 14 times higher wear resistance than 16C and approx. 5 times higher than 34F.

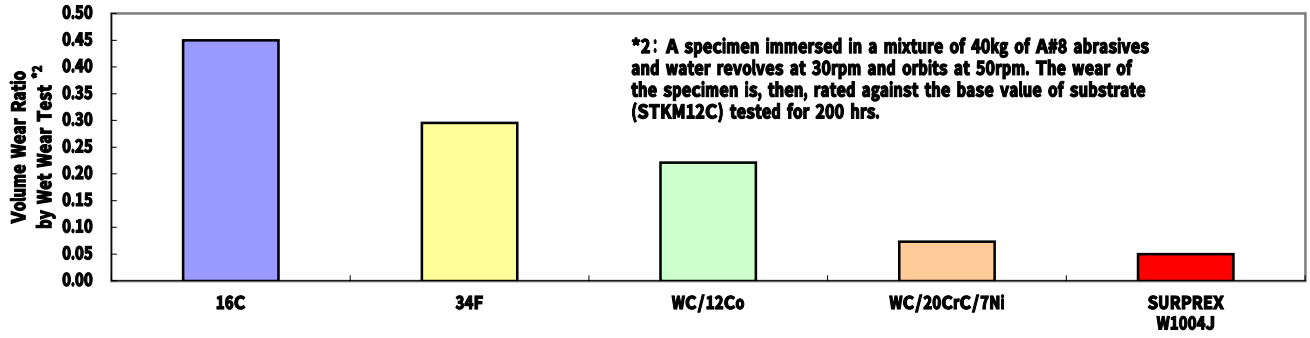


Fig.3 Wet Wear (Slurry Erosion) Resistance Test

While WC/Co-type cermet coatings are rarely used in wet or corrosive environment, WC/20%CrC/7%Ni or WC/10%Co/4%Cr is generally rather preferred. W1004J with equal or better wet wear resistance compared with WC/20%CrC/7%Ni will be a good candidate for use in wet environment.

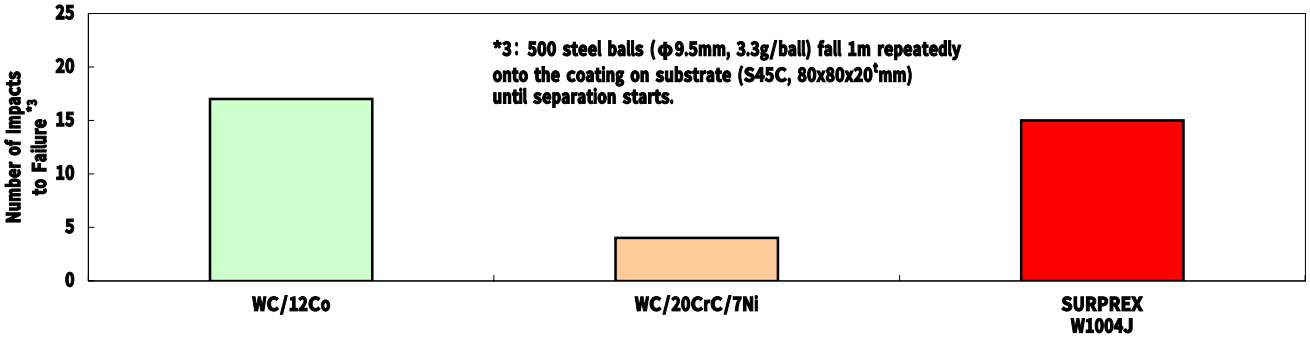


Fig.4 Impact Test A

WC/20%CrC/7%Ni is said to have poor impact resistance and relatively low adhesion strength to a substrate, whereas WC/12%Co generally performs with high toughness and excellent adhesion strength. W1004J demonstrates coating characteristics similar to WC/12%Co with higher impact resistance than WC/20%CrC/7%Ni.

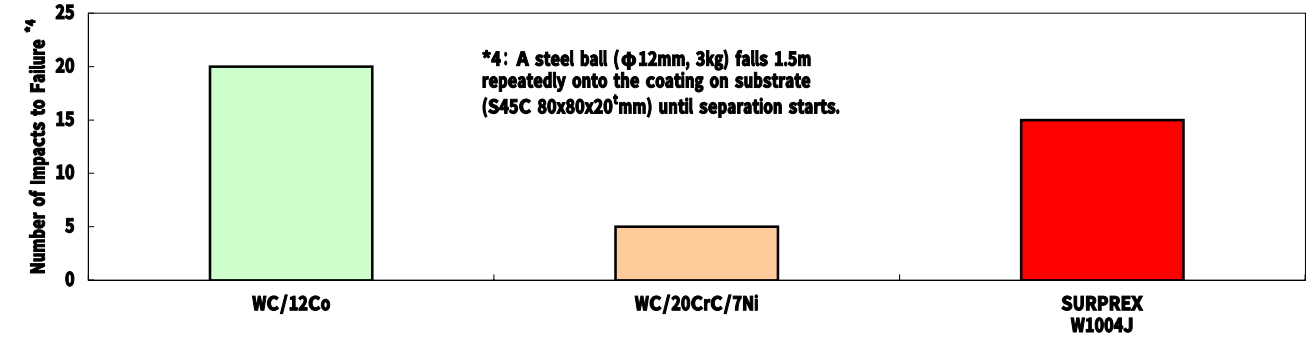
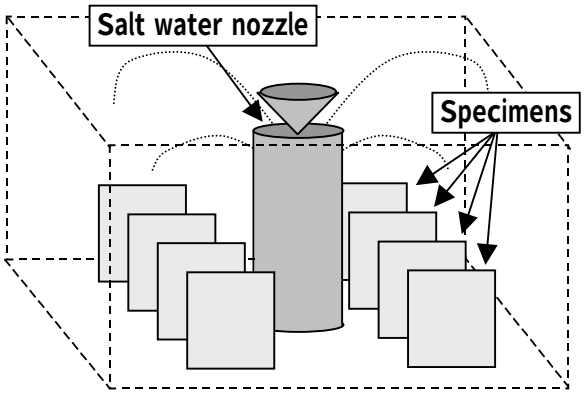


Fig.5 Impact Test B

While impact resistance shown in Fig.4 is determined through continuous impacts using 3.3g x 500 steel balls, the test shown in Fig. 5 employs a falling ball of 3 kg (a steel ball with large curvature) to give an extremely strong impact force per unit area. The results tend to be identical to Fig.4. W1004J has 3 times higher impact resistance than WC/20%CrC/7%Ni and shows expectancy of life close to WC/12%Co.

Salt Spray Test

Specimens are placed in a chamber and continuously sprayed with salt water. They are taken out every 24 hours to check the corrosion rate on the coating surfaces on a SS400 substrate.



Salt water concentration	5%
Test tub temperature	35±1°C
Air saturation machine temperature	47±1°C
Spray rate	1～2ml/hr
Spray pressure	0.098±0.002MPa

Test conditions

Spray distance	380 mm
Barrel length	4 inches
Exposure time	120 hours

Spray distance	300 mm
Barrel length	8 inches
Exposure time	240 hours

Fig.6 Coating surface after salt spray test

Fig. 6 exhibits the W1004J coating surfaces after the salt spray test. The two photos comparing the effects of the spray distance and barrel length demonstrate that the shorter the spray distance or the longer the barrel length gets, the less an amount of porosities becomes in the coating to inhibit rust formation in the substrate.

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