SURPREX W2000X Series

FUJIMI INCORPORATED
Technical Bulletin

Impact Resistant Cermets
SURPREX W2010XJ
SURPREX W2011XJ
SURPREX W2021XJ

The SURPREX W2000X series are agglomerated and sintered composite powders which consist of WC, Cr and Ni. Both excellent toughness and greatly improved impact resistance are achieved in sprayed coatings of W2000X range with wear resistance equal or superior to conventional WC cermet coatings. These revolutionary spray materials provide coatings to simultaneously achieve all three quality requirements of wear, corrosion and impact.

1. Types

There are three grades in the W2000X series of different Ni contents.

Type	Coating Hardness(Hv)	Anti-dry abrasion	Anti-wet abrasion	Anti-corrosion	Anti-impact
SURPREX W2010X	950	◎	○～◎	◎	◎
SURPREX W2011X	950	○～◎	○～◎	○～◎	◎◎
SURPREX W2021X	800	△～○	○	○～◎	◎◎◎◎
WC/20%CrC/7%Ni (reference)	1200	△	◎	△～◎	×
WC/12%Co (reference)	1250	○	△	×～△	△～○

Sprayed on JP-5000
Inferior × < △ < ○ < ◎ Superior

Three types of particle size are available to suit a variety of spray guns.

Type	Particle Size (μm)	Spray Gun
SURPREX W2010XJ	-53+10	JP-5000, JPW5, J gun, HVAF, Jet Kote, Axial III, etc.
SURPREX W2010XD	-45+10	DJ(Diamond Jet), HVAF, Jet Kote, etc.
SURPREX W2010XS	-38+5	SB-250, SB-500, θ gun, etc.

2. Properties

①Typical Chemical Compositions

wt.%

Element / Type	W	C	Cr	Ni	Fe
SURPREX W2010X	Bal.	6.8	17.6	17.0	0.07
SURPREX W2011X	Bal.	6.7	15.6	19.0	0.06
SURPREX W2021X	Bal.	5.4	13.9	28.0	0.06

②Typical Particle Size Distributions

Cumulative wt.%

Type \ Size	+53 μm	+45 μm	+32 μm	-15 μm	-10 μm
SURPREX W2010XJ	1.2	9.0	29.7	4.4	0.3

Cumulative wt.%

Type \ Size	+38 μm	+32 μm	-20 μm	-10 μm	-5 μm
SURPREX W2010XS	2.0	4.5	35.1	2.4	0.0

3. Coating Characteristics and Applications

①Characteristics
- Impact resistance
- Heat resistance
- Toughness
- Wet abrasive wear resistance
- Dry abrasive wear resistance
- Cavitation erosion resistance
- Corrosion resistance

②Applications
- Excavator tools
- Construction machinery parts
- Hydro-turbine parts for power generation
- Crushing machinery parts
- Rollers
- Screws
- Pump parts

4. Data on Coating Characteristics

The W2000X series are 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

Type \ Condition	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
W2000X Series	682	0.38	380	4

The sprayed and fused coating of 16C, self-fluxing Ni-based alloy (Ni-16%Cr-4%Si-4%B-3%Cu-3%Mo-2.5%Fe-0.5%C), is shown as a reference.

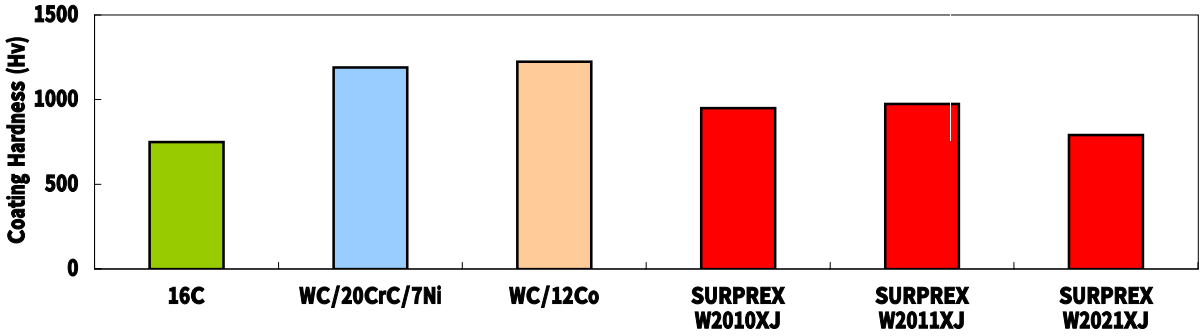


Fig.1 Coating Hardness

The highest hardness is obtained for WC/12%Co followed by WC/20%CrC/7%Ni. Both high metal bearing W2010XJ and W2011XJ containing high metal show Hv(200g)=approx.950, while W2021XJ with higher metal content and 16C indicate Hv=approx.800 and approx.750 respectively.

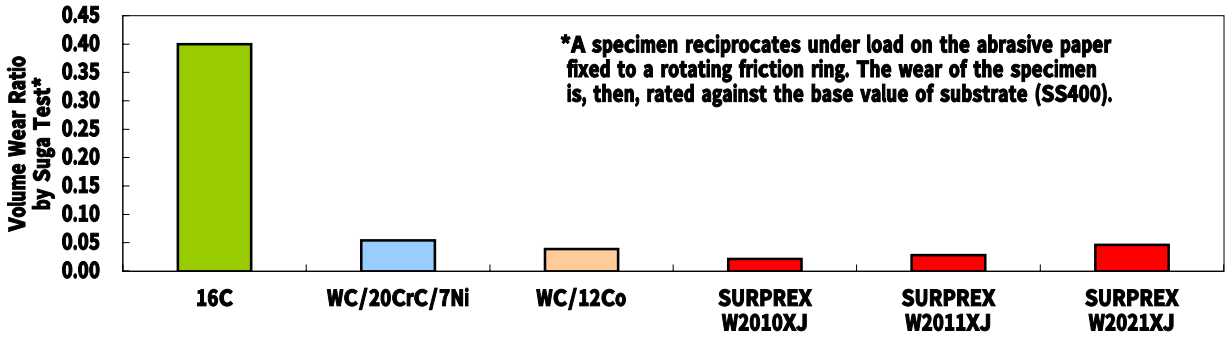


Fig.2 Results of Dry Abrasive Wear Test

WC cermets have 6 to 14 times higher dry abrasive resistance (Suga-method) than 16C, self-fluxing Ni-based alloy. WC/Co cermets, in particular, exhibit good abrasive wear resistance because of high hardness and toughness in addition to good adhesion to the substrate. W2021XJ is on a par with WC/12%Co. W2010XJ and W2011XJ are better than WC/12%Co and more than twice as good as WC/20%CrC/7%Ni.

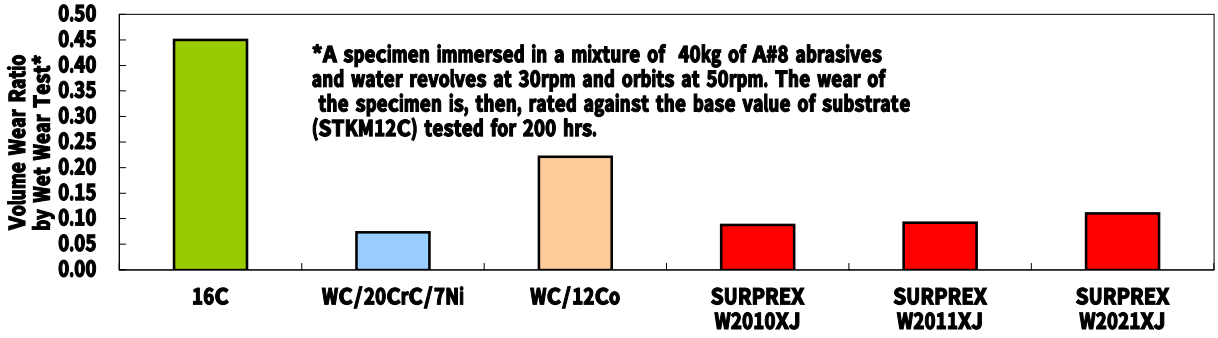


Fig.3 Wet Wear (Slurry Erosion) Resistance Test

As WC/Co cermets perform poorly in a wet environment, WC/20%CrC/7%Ni or WC/10%Co/4%Cr is generally favored. The W2000X range demonstrate wet wear resistance similar to WC/20%CrC/7%Ni.

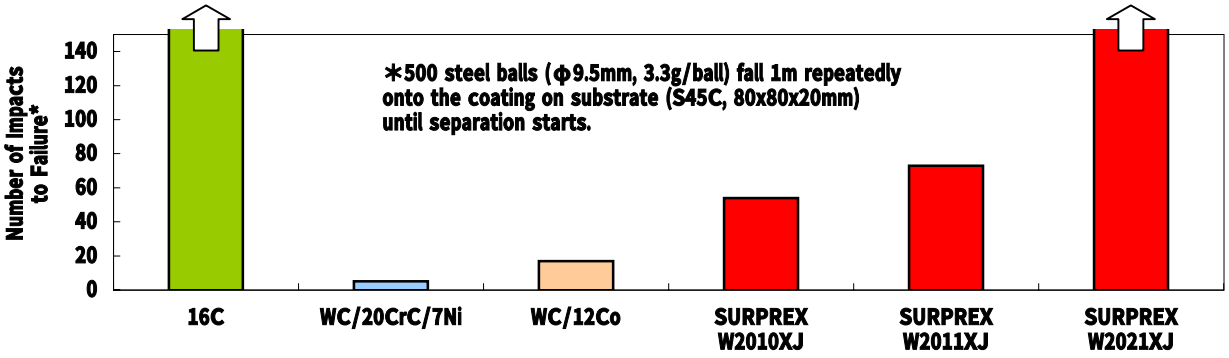


Fig.4 Impact Test A

Whereas WC/20%CrC/7%Ni clearly lacks impact resistance and probably also adhesion to the substrate, WC/12%Co performs better. The W2000X series show more than doubled impact resistance compared with WC/12%Co, with W2021XJ in particular withstanding over 300 impacts.

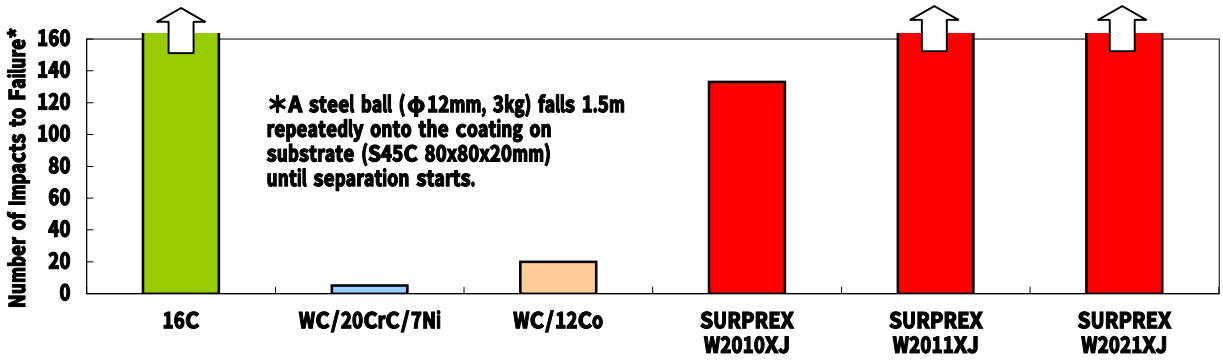


Fig.5 Impact Test B

While impact resistance in Fig.4 is measured for continuous impacts by 3.3g x 500 steel balls, a 3kg steel ball with large curvature is used to give an extremely severe impact loading, as shown in Fig.5. While the results tend to be almost identical to those in Fig.4, W2010XJ is more than 15 times better than WC/20%CrC/7%Ni. Both W2011XJ and W2021XJ have a life of over 200 impacts, far better than conventional WC cermets.

5. Testing Rigs

The testing rigs used above will be described.

◎Wet Wear (Slurry Erosion) Test Rig

Overview

Magnified View of Specimens and Their Surrounding

This rig designed and manufactured in-house is useful to evaluate wear by earth in a wet environment.

Before Test

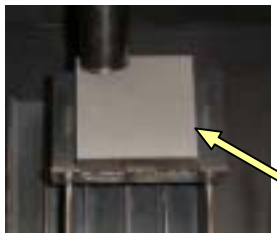
After Test

◎ Impact Test Rig A

Overview

Steel Balls
(3.3g×500 balls)

A relatively small impact is repeatedly imparted to evaluate a life of the coating.



Specimen and its Surrounding

Before Test

After Test

◎ Impact Test Rig B

Overview

Falling Ball

Specimen and its Surrounding

Before Test

After Test

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