



Applications and Contribution

Diecasting Plastic-molding Press-process Cutting-Tool



- 1. Diecasting p2 - p6**
- 2. Plastic-molding p7 - p10**
- 3. Press processing p11 - p13**
- 4. Cutting Tool p14 - p15**
- 5. The other parts p16 - p18**

< For mold >

【Defects】

Heat crack, Stress corrosion, Seizing, Melting, galling, wear, poor material flow, poor gas release

【Countermeasure by OX-process】

Improvement residual compressive stress, surface hardness improvement,
Change the half - width at half-maximum (crystal lattice density change),
and Improved tribological properties.

【Effect】

Reduction of molding defect, Easy release product, Increase of mold life

< For machine parts >

【Use Cases】

Sleeves, plunger tips, pins, and ruddles

【Defects】

Seizing, deformation, melting, welding, poor material flow, poor sliding properties

【Countermeasure by OX-process】

Improvement of tribological properties and formation of plateau structures.

【 Effect 】

Reduced processing defects, Reduced maintenance time and number of times, Increase life

< The effect for products due to process to Mold >

【Defect】

Poor material flow, Porosity, Surface peeling, Seizing, Chill layer

【Effect】

Improvement material flow and degassing ⇒ Improvement of processing defects



Equipment

< Processing for products >

【Defect】

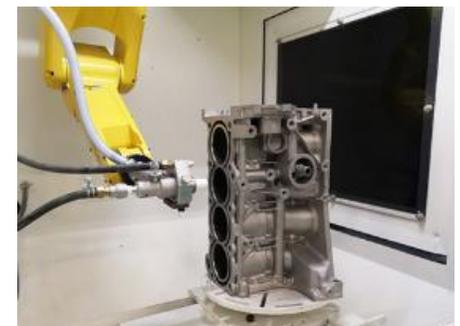
Not enough fatigue strength, Wear, Poor sliding properties

【Countermeasure by OX-process】

Improvement residual compressive stress, Increase surface hardness,
Change the half - width at half-maximum (crystal lattice density change),
Improvement of tribological properties

【Effect】

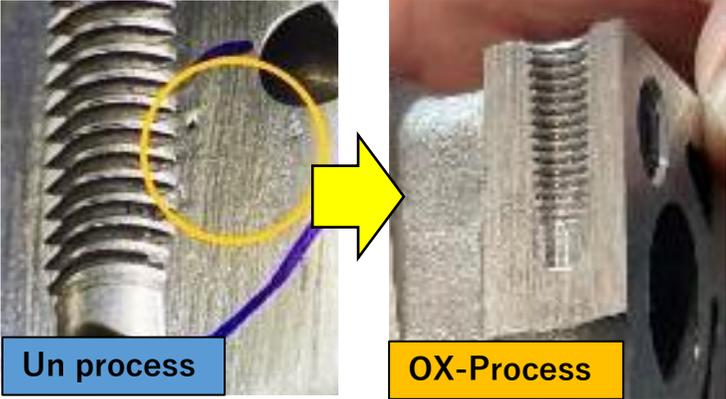
Improved wear resistance and fatigue strength ⇒ Increase life



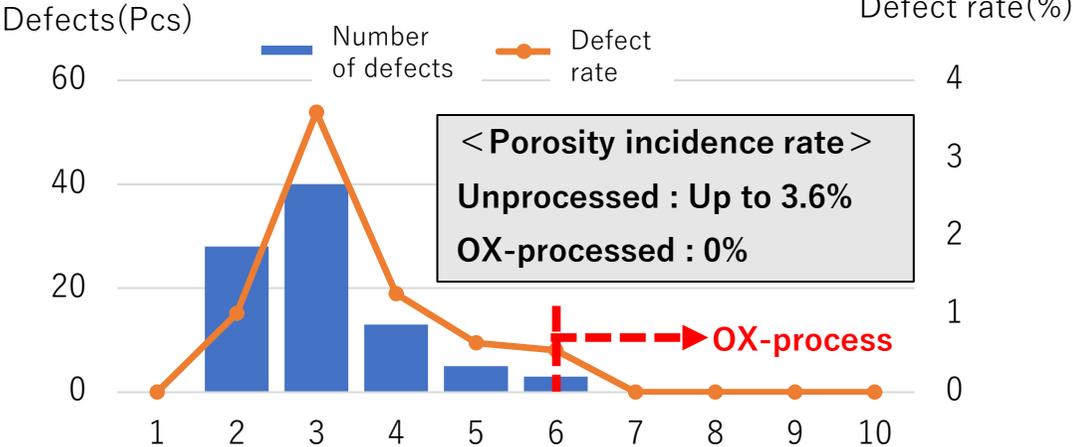
Processing with Robot

Application for Diecasting

- For Mold : Reduced processing defects



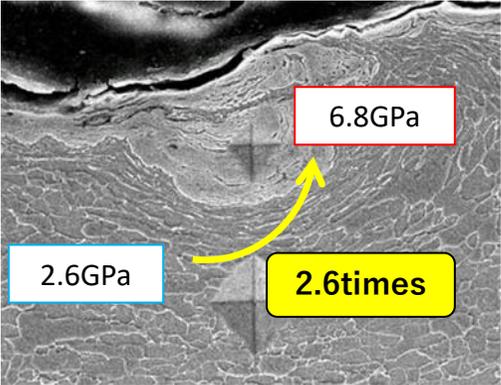
Countermeasures process to mold



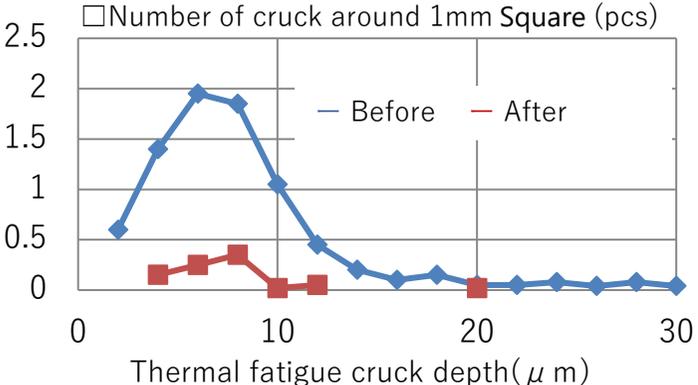
Porosity reduction Data

< Porosity incidence rate >
 Unprocessed : Up to 3.6%
 OX-processed : 0%

- For Mold : Improved heat crack resistance



Metal structure before and after process

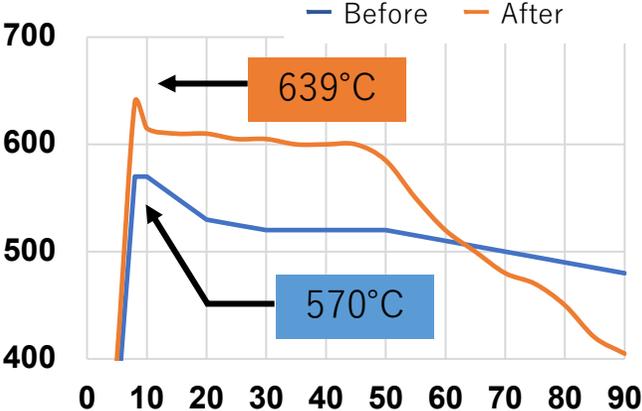
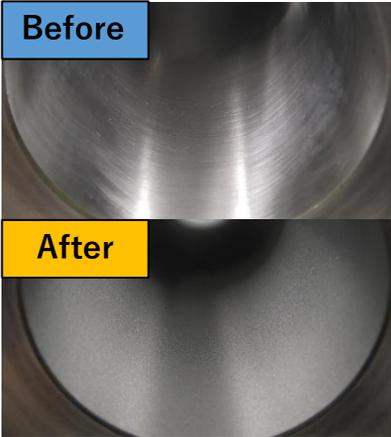


Thermal fatigue crack depth and number of cracks.

< Test Method >
 1. Pressed to 660°C plate
 2. Water cooling (around 30°C)
 3. Observation of the number of heat cracks in surface.
 Number of cycles : 2000 cycles
 Sample material : SKD61 / Quenching and tempering
 → Average value in observed in 10 places

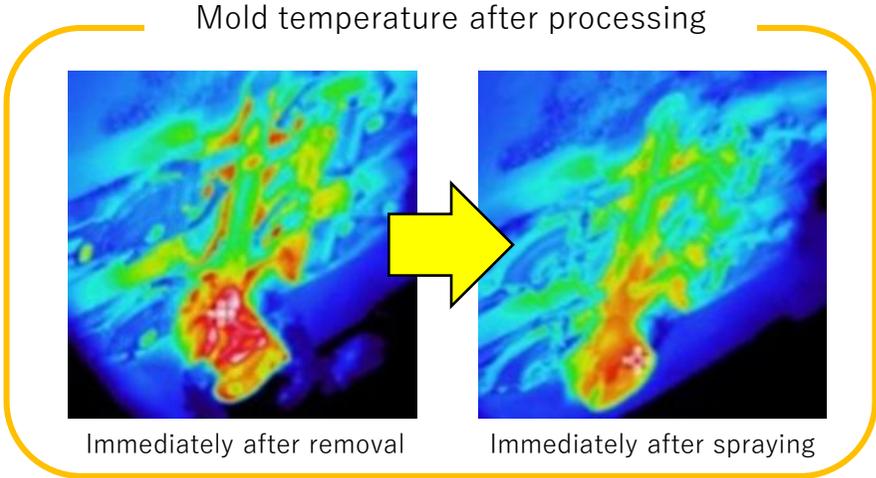
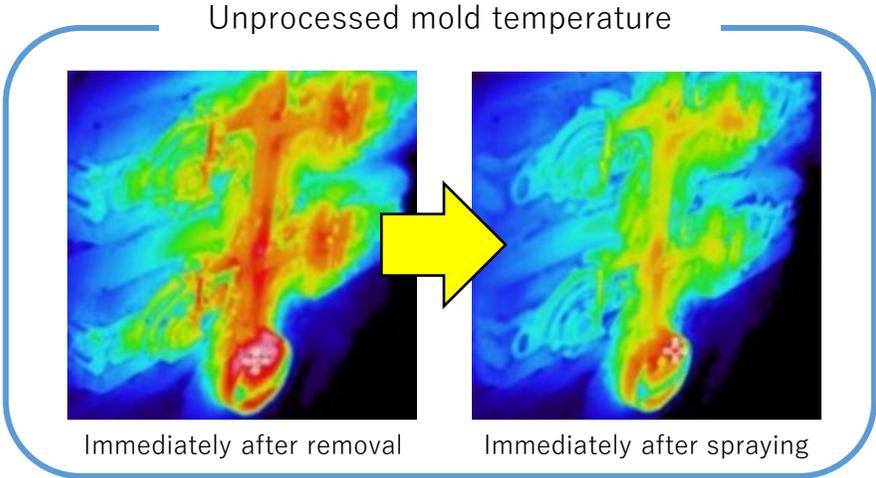
Application for Diecasting

- For Sleeve : Improved casting material temperature



Material temp. into Mold : Increase 30 - 40°C
 (Before OX 620~630°C→After OX 660°C)
Solidification sheet volume : ▲28% - ▲39%
Product casting hole incidence : 3.4% → 0.8%
Sleeve deformation : ▲0.2mm
 (Amount of longitudinal deformation)

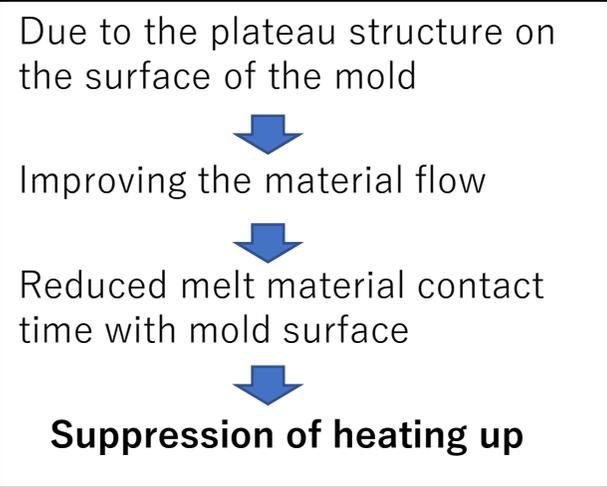
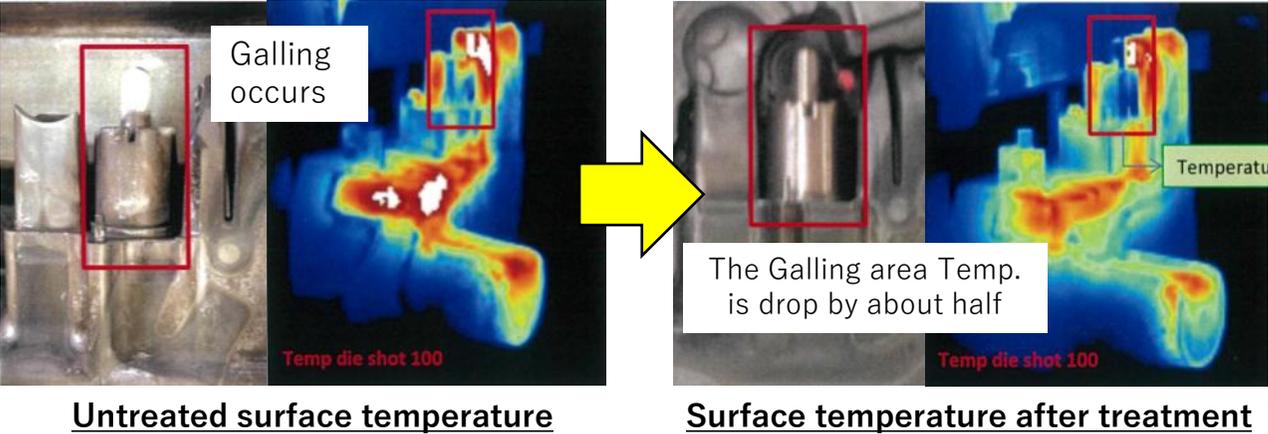
- For mold : Thermal conduction inhibition effect



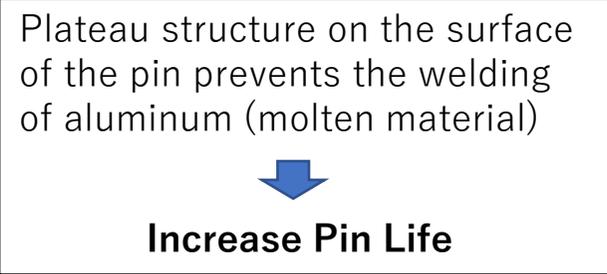
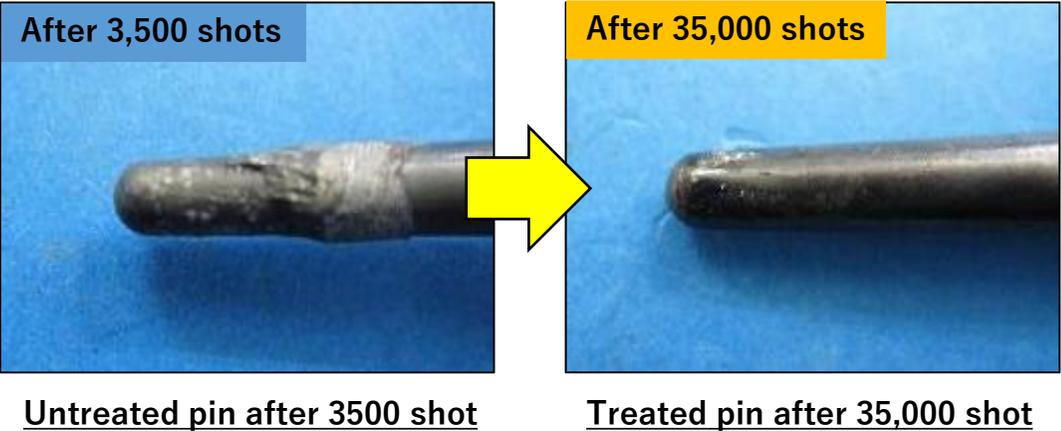
OX-Process improves material flow in the mold by 20% - 30%

Application for Diecasting

- For mold : Suppression of heating up



- For core pin : Increase Life by Reducing Aluminum Welding



< For mold >

【Defects】

Poor material flow, Poor outgassing, Wear, Contamination into product, Galling

【Countermeasure by OX-process】

Improvement residual compressive stress and tribological properties, Increase surface hardness

【Effect】

Improvement of material flowability, outgassing and release ⇒ **Improvement of processing defects**

Improved durability, breakage resistance, abrasion resistance, and scratch resistance ⇒ **Increase the life**

< For Processing into machine parts >

【Use Cases】

Screws, Cylinders, Tip-set, Nozzles, Hopper

【Defects】

Poor product release from mold, poor material flow, poor outgassing, wear, contamination into product

【Countermeasure by OX-process】

Improvement residual compressive stress and tribological properties, Increase surface hardness

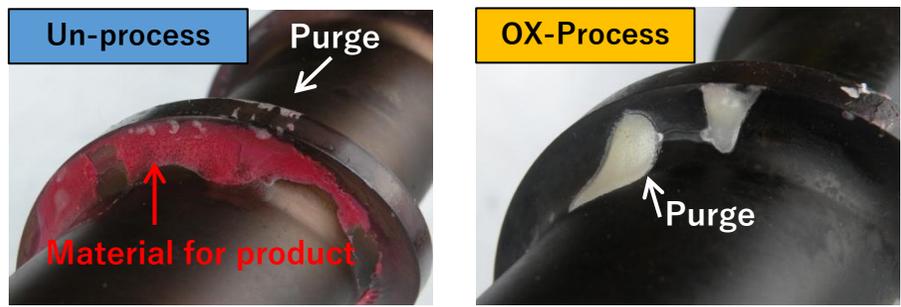
【Effect】

Improvement flowability, outgassing, and release ⇒ **Improvement of molding defects and maintenance**

Improved durability, breakage and abrasion resistance ⇒ **Increase of parts life**

Application for Plastic molding

- For Screw : Product easy release / abrasion resistance / improved material flowability



By improving material release properties
Easy resin discharge with purge material

By Riblet structure
Improves resin flowability and release

- For mold : Effect of reducing fluid resistance

	Un treatment	Ox-process	Effect
Resin Discharge	91.2g/min	111.0g/min	+19.8g/min (122%)
Pick-up machine Pull-up speed	1.05m/min	1.30m/min	+0.25m/min (124%)
Pick-up machine Motor Current Value	0.77~0.80A	0.71A	-0.08A (90%)

< Resin extrusion moldings test >
Extrusion resin dosing volume and Improvement of pull-up speed and motor current value

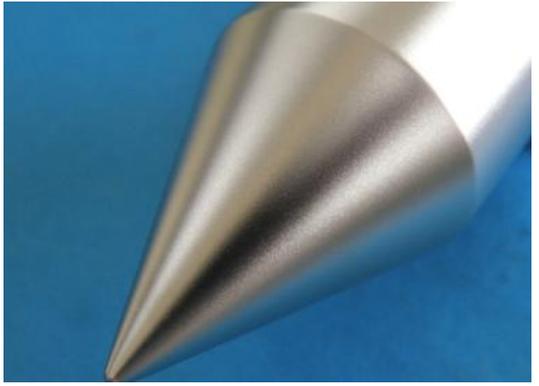
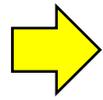
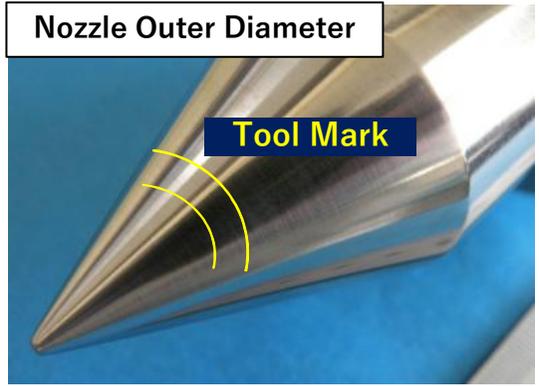
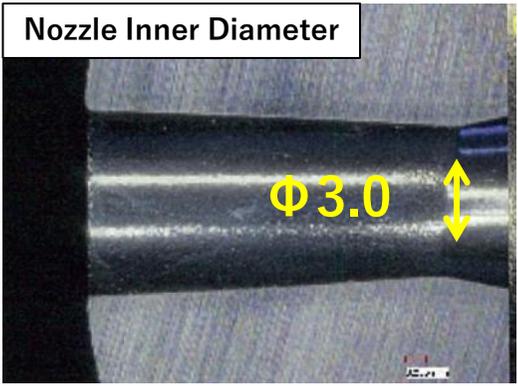
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Improved formability and cost reduction effect

Material : PVC / 850B-WH3

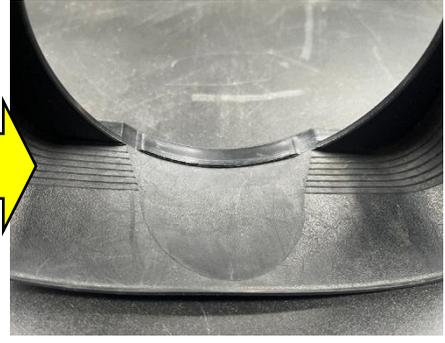
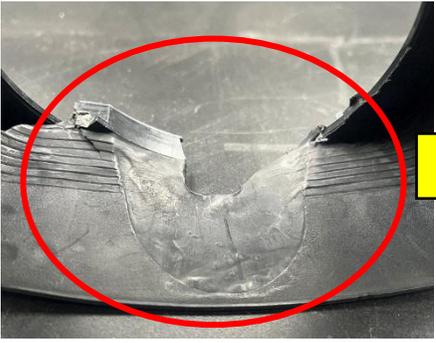
Application for Plastic moldings

- For Nozzle : Improved resin flowability and release



Minimum inner diameter that can be processed = $\phi 0.1\text{mm}$
Improved flow characteristics by removing tool marks

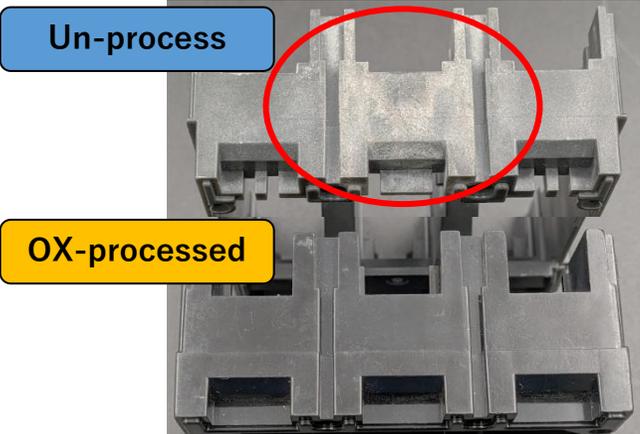
- For mold : Improvement of Filling Defects < Product Material : Elastomer >



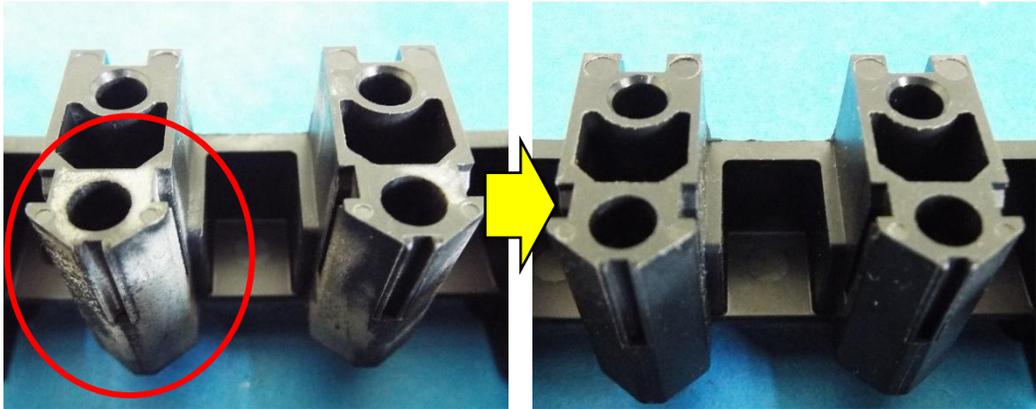
Improvement of Poor material Filling

Application for Plastic moldings

< Product : Breaker Cover >



Improvement of Poor Filling



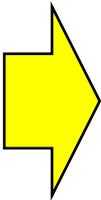
Un-Process

OX-processed

< Product : Plastic molded products >



Filling defects caused by unprocessed mold



Used the OX-processed mold

OX-Process for Press processing



【Use Cases】

Punches, dies, plates

【Defect】

burn due to oil film breakage, Wear, Product burrs, product spring-backs, wrinkles, cracks, Slug-Pulling

【Countermeasure by OX-process】

Improvement of surface hardness and formation of plateau structures.

【Effect】

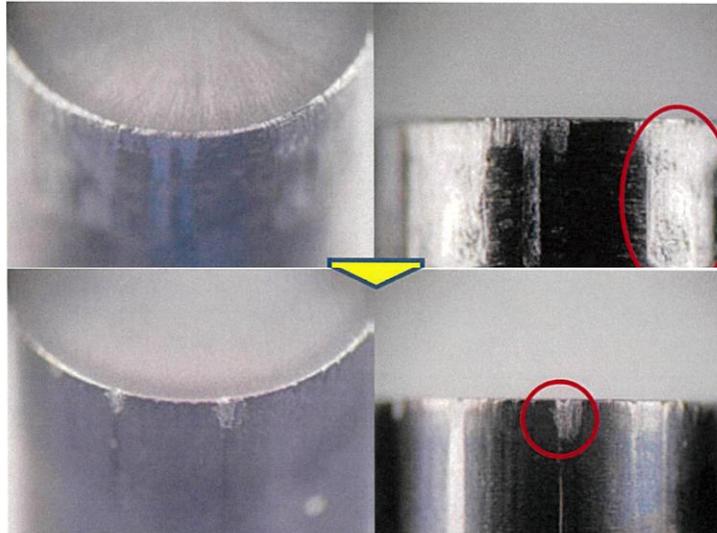
Adhesion of surface coatings, improvement of wear resistance ⇒ **Increase of tooling life**

Reduction of shear resistance by improving sliding resistance ⇒ **Improvement of product shear length.**

● Punch : Improved tooling life

PVD(TiCN) only

OX-FSP
+PVD(TiCN)
+OX-FSP



Material: SKH51
Test: SUS304 Punching Life Test
Number of processing : 200,000 shots

By improving the adhesion of the surface coating



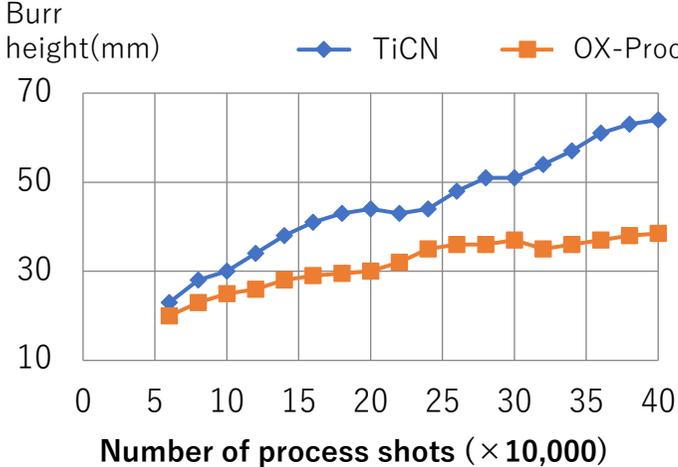
Improved peel off and abrasion resistance



Increase tool life

Application for Press processing

- Punch : Improvement of mold life / Measures against burr generation**



< Test condition >
 Processed material : 980MPa class high-tensile material
 Plate thickness : 1mm
 Clearance : 5% on one side
 Punching shape : ϕ 4.1mm
 Lubrication : No lubrication
 Punching Speed : 200m/s

PVD(TiCN) Only



PVD (TiCN) processing only : 20,000 shots
 OX-FSP+PVD (TiCN) : 100,000 shots
 ↓
5 times longer lifespan

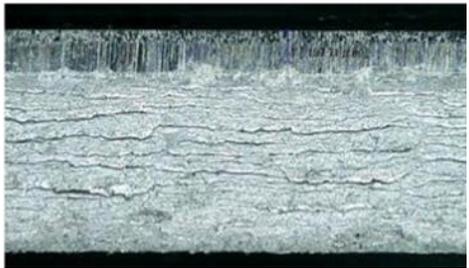
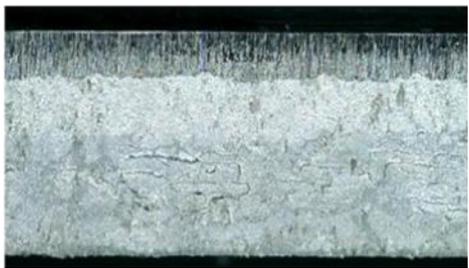
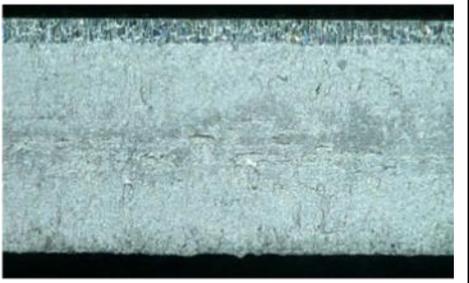
OX-FSP +PVD(TiCN) +OX-FSP



Improved shear length
 Improved fracture surface roughness
 ↓
Suppression of burr occur

Application for Press processing

- Hole punch : Increased shear length

	Material : A	Material : B	Material : C
Un-Process			
shear length	0.24 – 0.27 mm	0.27 – 0.31 mm	0.07 – 0.12 mm
	Material : A	Material : B	Material : C
Add OX-process			
Shear length	0.27 – 0.31 mm	0.34 – 0.39 mm	0.12 – 0.15 mm

14%~48% increase in shear length by increase sliding properties

OX-Process for Cutting Tool



【Use Cases】

Drills, Taps, End mills, Hob cutters,
Chip Saw, Metal Saw, Vanishing Reamer,
Rolling racks, Chips, Broaches, Single point tool

【Material】

Tungsten Carbide, HSS(SKH), SKD, Cermet

【Defect】

Chipping, wear, built-up cutting edge, Poor fatigue strength, Short life, Variation

【Countermeasure by OX-process】

Increase Residual compressive stress, Increase surface hardness,
cutting edge smoothing, and improvement tribological properties

【Effect】

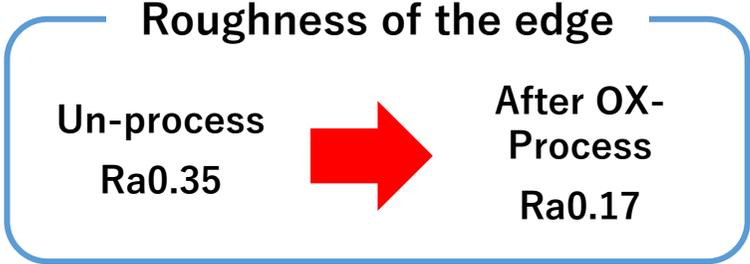
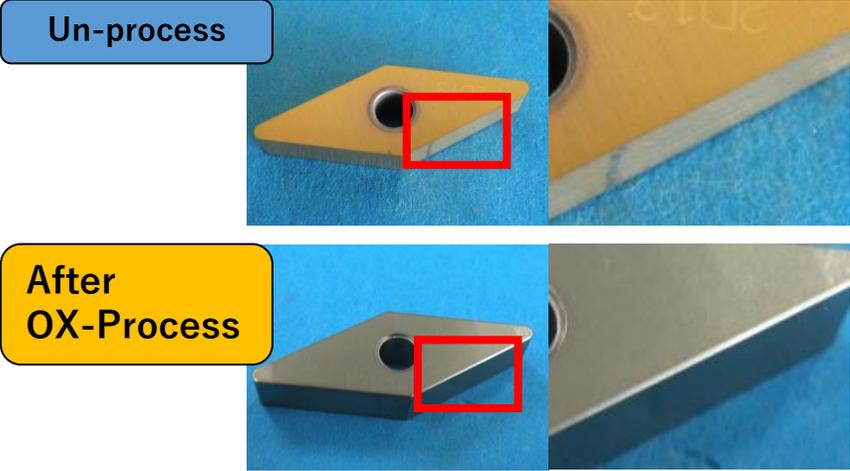
Adhesion of surface coatings, Improved wear resistance, Improved chipping resistance,
Reduced cutting forces ⇒ **Increase life**

Manage built-up cutting edge ⇒ **Increase life and reduce the roughness of product**



Application for Cutting Tool

- Chips : Increased Lifespan



Longer life by smoothing the edge
Extended service life by anti-chipping
Product surface roughness countermeasures

【Life-improving effects on major tools】

	Drill	Drill	Tap	Vanishing Reamer	Metal Saw	Chip	Broach	Single point tool	Dies
Material	SKH	Tungsten Carbide	SKH	Tungsten Carbide	HSS	Tungsten Carbide	SKH	SKH	HSS
Life	×3~10	×2~4	×2~4	×2~4	×2~3	×2~3	×2~4	×2~3	×2~3

<Winding machine parts >

【Target】

Improved motor performance due to increased winding rate

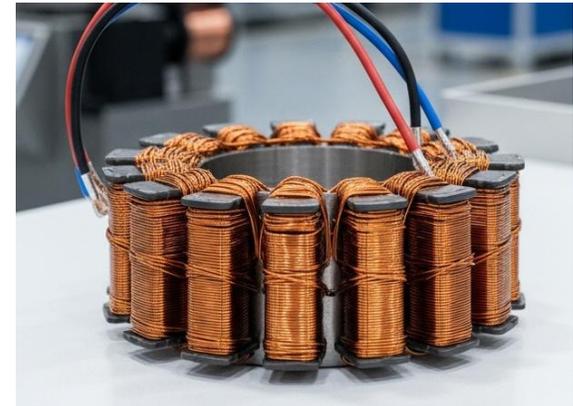
【Countermeasure by OX-process】

Reduced resistance from the OX process to the fixture

Improves wire stretching, damage, and tearing.

【Effect】

Increased winding rate (4~5%)



Motor Coil

<Soldering iron >

【Issues】

Melt loss, low lifetime of soldering iron tool

【Effect】

Reuse the Soldering iron tool

Increased life (3~10 times)



Soldering iron tool

< Contact Tips >

【 Issues 】

Short life due to internal wear, adhesion of outside sputter

【Effect】

Increased lifespan 2~3 times



Contact Tips

< Metal 3D Printer Printing Parts >

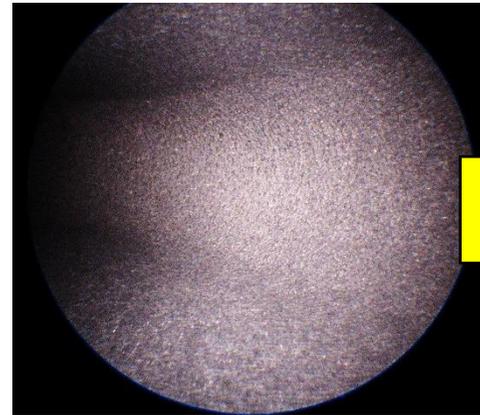
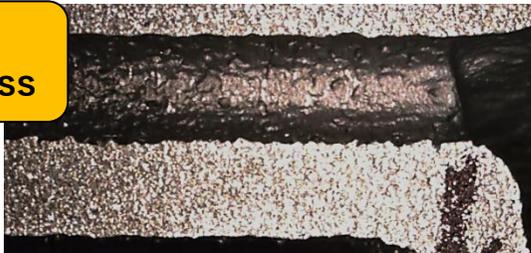
【Effect】

Adhesion removal, Improvement of surface condition of inner diameter

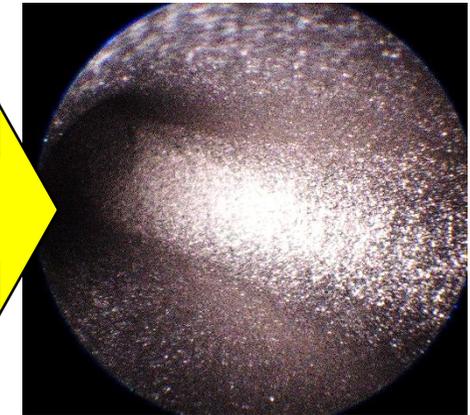
Un-process



After
OX-Process



Un-process



After OX-process

OX-Process for others

< Propeller >

【Target】

Improved flow properties

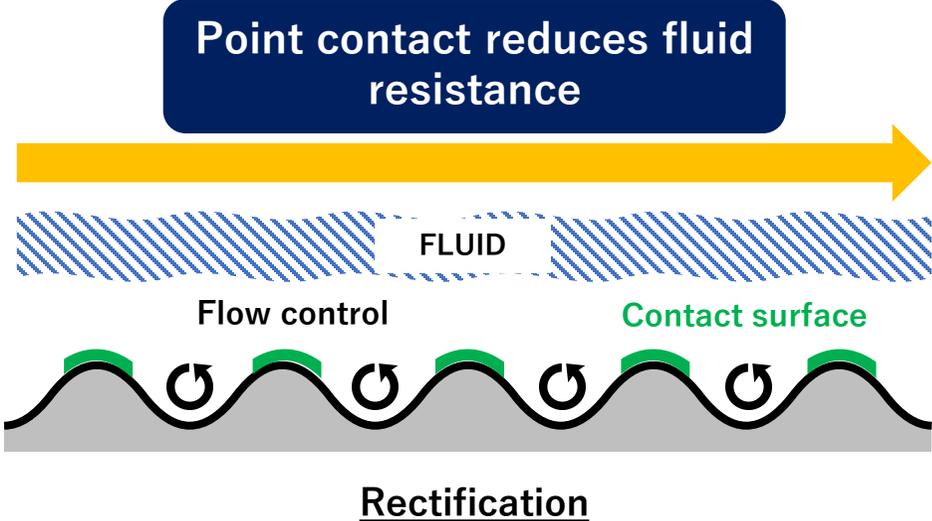
【 Countermeasure by OX-process 】

Formation of a riblet structure

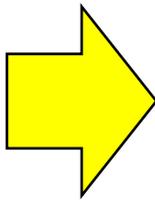
【Effect】

rectification

(Improved flow of liquids and gases)



Un process



Shot blast surface



Spline



Diamond

Various shapes and depths can be created by OX-Process



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