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OXISO Improves it to the Next Stage with FSP

OXISO

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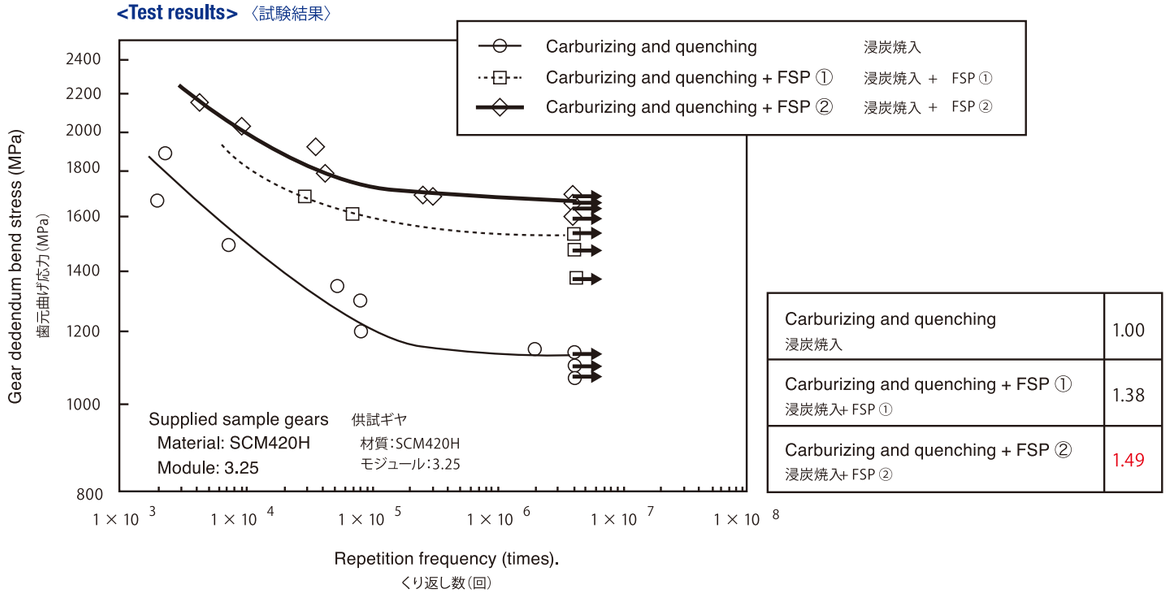
Bending fatigue stress test results
〔曲げ疲労強度比較〕

<Test results> 〈試験結果〉

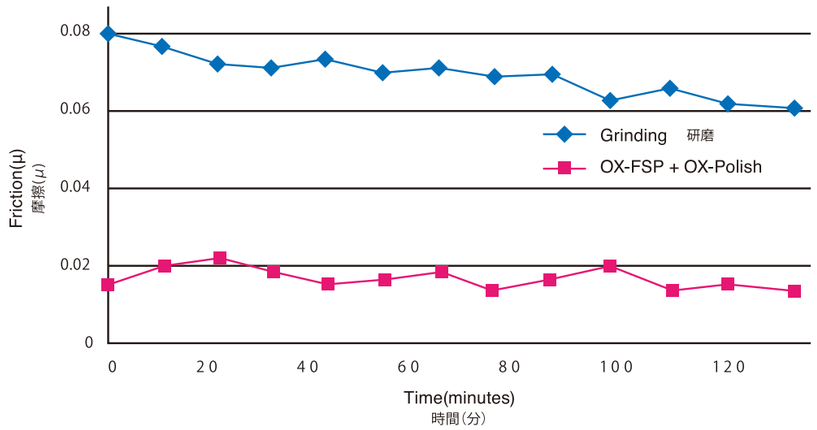


Carburizing and quenching 浸炭焼入	1.00
Carburizing and quenching + FSP ① 浸炭焼入+ FSP ①	1.38
Carburizing and quenching + FSP ② 浸炭焼入+ FSP ②	1.49

Friction wear test results
〔摩擦摩耗試験結果〕

Friction coefficient is 0.06 to 0.08μ with the conventional grinding method, but it falls by “break-in wear” over time. Friction coefficient stabilizes in the range from 0.01 to 0.02μ with OX-Polish.
It is recognized that the surface is of high wear-resistivity and low friction.

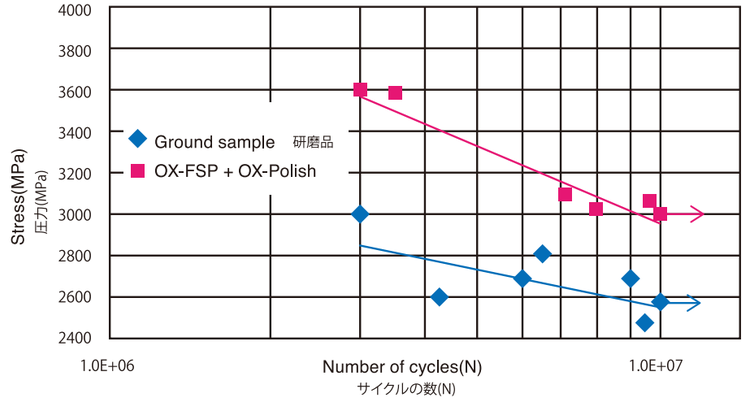
従来の研磨方法では摩擦係数が0.06～0.08μであるが、時間経過と共に「なじみ摩耗」により摩擦係数が下がる。
OX-Polishでは0.01～0.02μで安定した低い摩擦係数を維持している。
耐摩耗性の高い低摩擦性表面であることがわかります。



<Test conditions>
Test method: Pin-on disk
siding speed: 1.2m/sec
Contact pressure: 1.2MPa
Lubricant: E/O SAE10W-40
Test samples: SCM420H carburized and tempered.

〈試験条件〉
試験方式:ピン オン ディスク
摩擦速度:1.2m/sec
面圧:1.2MPa
使用潤滑油:E/O SAE10W-40
試材:SCM420H 浸炭焼入れ焼戻し

Roller pitching test results
〔ローラーピッチング試験結果〕



・Pitching limit Ground sample Pmax≒2600MPa
・ピッチング限 研磨品
OX-FSP+OX-Polish Pmax≒3000Mpa

⇒ 15% UP (improved) compared with ground sample.
⇒ Free of oil contamination even after test.

⇒ 研磨品と比較し、15%UP
⇒ 試験後の油が汚れていない

Less oil deterioration = Longer product life

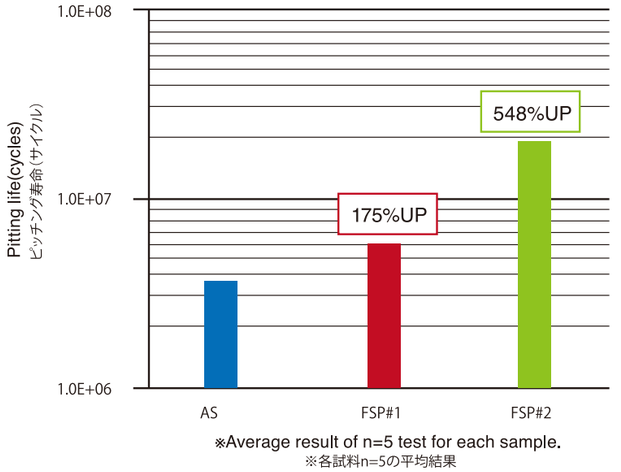
オイル劣化が少ない ＝ 製品 長寿命化

[Remarks]
Results of roller pitching test after grinding and OX-polish.
Roller diameter: large roller ϕ130, small roller ϕ26
Material: SCM420 carburized
Roughness: Grinding sampleRa0.7
OX-FSP+OX-Polished sample Ra0.1
Slipping rate: –40%
Rotation speed: Approx. 1,500 rpm
Lubricant: ATF

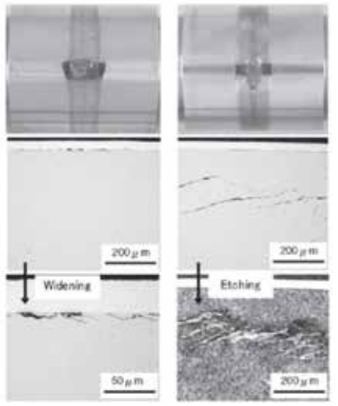
[備考]
研磨状態とOX-Polish後のローラーピッチング試験結果
ローラー径:大ローラ φ130　小ローラφ26
材料:SCM420　浸炭
粗度:研磨品Ra0.7　OX-FSP+OXPolish品Ra0.1
すべり率:-40%
回転数:約1500回転
潤滑油:ATF

<Test results>
〈試験結果〉

	No.	Number of cycles
SCM420H	AS	3,495,696
	OX-FSP#1	6,131,482
	OX-FSP#2	19,163,968



※Average result of n=5 test for each sample.
※各試料n=5の平均結果



(a)AS　(b)FSP#2

Application to helical gears
〔ヘリカルGEARへの適用〕

Application to gears - measures against pitching, improvement of fatigue strength, and silencing.

Helical gear's tooth flank and tooth bottom can be ground, unlike the machines in the past.
Improvement of tooth fatigue strength by OX-FSP, and crowning on 'plateau' surface and tooth top by OX-Polish.

(Application)
Gears for construction machines and speed reducers.
(Effect)
Attained 2.8 times longer durability.
Time between maintenances is made two times longer, contributing to cost reduction.

GEARへの適用
～ピッチング対策･疲労強度UP･静音化～

これまで不可能だったヘリカルギヤの歯面･歯底も研磨可能。
OX-FSPで歯元疲労強度ＵＰ＋OX-Polishでプラトー表面＋歯先クラウニング。

（適用例）
建機用GEAR、減速機GEAR
（効果）
これまでの2.8 倍以上の耐久時間をクリア。
メンテ期間が2倍となり、減価削減に寄与した。

Application to gears
〔GEARへの適用〕

Application to gears - measures against pitching, improvement of fatigue strength, and silencing.

Reduction of weight and noise of gears (such as cam gears, etc.) used in engines are realized by OX-FSP and OX-Polish.

(Application)
Cam gears for diesel engines
(Effect)
Tooth width is thinned by 15%, and fatigue strength is improved by OX-FSP treatment.
Considerable reduction of sliding resistance, and reduction of gear noise by 30%.

GEARへの適用
～ピッチング対策･疲労強度UP･静音化～

エンジン内部に使用されるGEAR(カムギヤ等)へOX-FSP＋OX-Polishを施工することで、GEAR軽量化+静音化を実現。

（適用例）
ディーゼルエンジン、カムギヤ
（効果）
歯幅15%薄幅化-OX-FSP処理により疲労強度ＵＰ。
摺動抵抗を大幅に低減-GEAR音30%減。

Cam gear for diesel engine.
エンジン用ーカムGEAR

Magnified view of tooth face (× 200)
歯面拡大写真×200

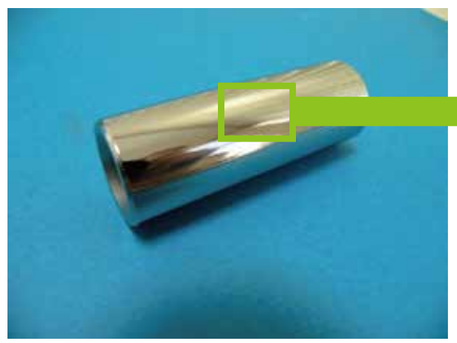
Reduction of friction resistance of sliding part
〔摺動部品の摩擦抵抗低減〕

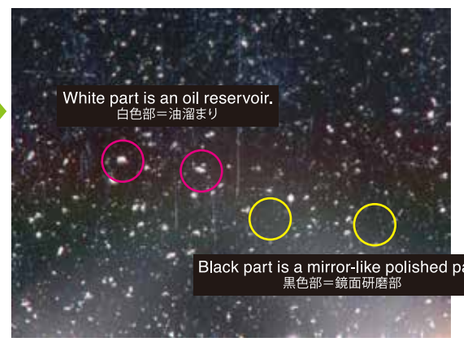
A plateau-like structure is formed on the surface of piston pin, and high fatigue strength and low friction coefficient are implemented.
Applicable to roller finger followers.

(Application)
Piston pin for motorcycle and automobiles.
(Effect)
Considerable reduction of sliding resistance by the plateau-like structure on the surface.
Reduction of power loss by 1%, and thinning by 10%.

ピストンピン表面にプラトー構造を形成し、「高い疲労強度+低い摩擦係数」を実現。
ローラーフィンガーフォロアに適用可能。

（適用例）
二輪･四輪 ピストンピン
（効果）
製品表面をプラトー構造化-摺動抵抗を大幅に低減。
パワーロス改善率1%＋薄肉化10%。





Piston pin for motorcycles
二輪用PIN-PISTON

Magnified view (× 200)
表面拡大写真×200

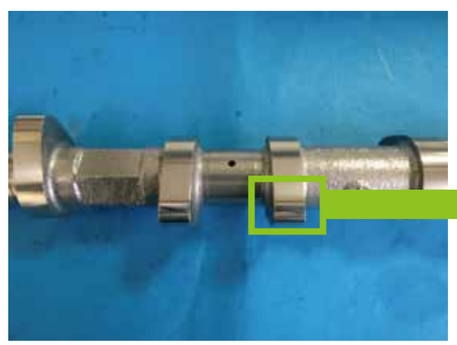
Improvement of fatigue strength and sliding performance of FCD materials.
〔FCD材の疲労強度UP＋摺動性UP〕

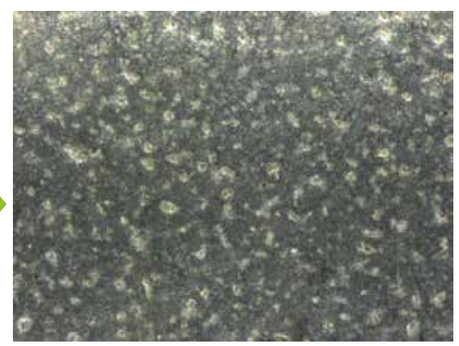
Application of OX-FSP+OX-Polish to FCD camshafts contributes to improvement of oil retaining by better fatigue strength and plateau-like structure on the surface.

(Application)
FCD materials of Camshafts.
(Effect)
The fatigue strength is improved by OX-FSP treatment, and the bench-test durability is improved up to 150%.
Considerable reduction of sliding resistance, and improvement of oil retaining performance by the plateau-like structure.

FCD材カムシャフトへOX-FSP＋OX-Polishを施工することで、疲労強度UPとプラトー表面化での油保持性UPを実現。

（適用例）
カムシャフトＦCD材
（効果）
OX-FSP処理により疲労強度ＵＰベンチ耐久150%。
摺動抵抗を大幅に低減=プラトー構造による油保持性UP。





Camshaft for motorcycle
二輪用PIN-PISTON

Magnified view (× 200)
表面拡大写真×200

An example of application to die-cast mold
〔ダイカスト金型への適用例〕

AT drums for automobile makers.

(Mold life)
Improved to 120 to 140%
(Defect rate of product)
12% on average => to 1 to 2%

Transfer axle cases
(Mold life)
It extends to 150% or more.
(Defect rate of product)
About 8% on average => to 1 to 2%

各自動車メーカー向けATドラム
（金型寿命）
120% ~ 140% へ向上
（製品不良率）
平均12%程度 ⇒ 1~2%へ

トランスファアクスルケース
（金型寿命）
150% 以上へ延長
（製品不良率）
平均8%程度 ⇒ 1~2%へ

Gravity die's life is extended and moldability is improved
〔グラビティ金型の寿命延長・成形性・離型性向上〕

Occurrence of heat crack is reduced by nanometrically crystallizing surface grains with OX-FSP process.
Molten aluminum runs deeper in narrow areas because of better affinity, and that considerably lowers the defect rate.

(Purpose)
Extension of the life of gravity dies, and improvement of moldability andmold release.

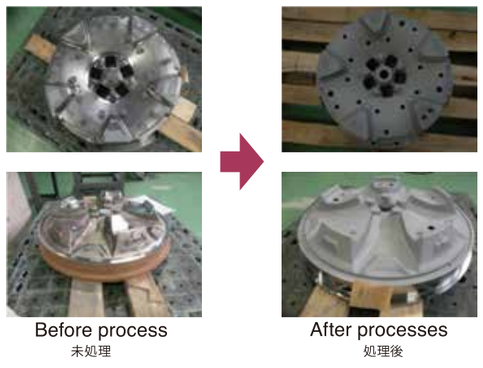
Insert for motorcycles.

(Effect)
Mold life is improved to about 150%
Defect rate is reduced from 30% to 0.2%

OXーFSP処理により、表面をナノ結晶化しヒートクラックの発生を低減。
濡れ性向上により湯回りが改善し不良率を大幅低減。

（目的）
グラビティ金型の寿命延長・成形性・離型性の向上
二輪ホイール用中子
（効果）
耐久ショット数約150% へ
不良品発生率 30% ⇒ 0.2% へ

Die of the die-casting ダイキャスト型



Before process
未処理

After processes
処理後

Improvement of flow of molten metal.
・Ripple mark ・Segregation ・Porosity ・Adhesion
(Effect)
molten flow is improved and defect rate is reduced
30% => 0.2%.

湯流れ性を改善
・湯じわの発生・湯境不良・巣の発生・焼付きの発生
（効果）
湯流れ性が向上不良率 30% ⇒ 0.2%

Motor frames for electric automobiles.
(Effect)
Durability shot count is improved to about 150%
Defect rate is reduced from 30% to 1% or 2%

電気自動車用モーターフレーム
（効果）
耐久ショット数約150% へ
不良品発生率 30% ⇒ 1%~2% へ

Application to core pins
〔鋳抜きピンへの適用〕

Considerably reducing aluminum adhesion and elongate the life by the process combinations of OX-FSP+OX-Polish+Ti coating for core pins.

(Purpose)
・Reduction of aluminum adhesion (which improves maitainability.)
・Improvement of pin life
(Effect)
Mold life is elongated by about -1000% or more.

鋳抜きピンへOX-FSP+OX-Polish+Tiコートの複合処理を施すことでアルミの溶着を低減・寿命を大幅に延長可能。

（目的）
・アルミの溶着を低減（メンテナンス性向上）
・ピン寿命の向上
（効果）
金型寿命 約1000%以上

A company: Damage by adhesion.
Short life: 3,000-4,000 shots.
・Production lot: 8,000 shots.
・Change during production (1 or 2 times).
Productivity impairment and cost raise.

A社: 焼付きによる破損
寿命が短い 3,000~4,000ショット
・生産ロット8,000ショット
・生産中に交換(1~2回)
生産性の阻害・コスト増

Conventional sample
従来品

OXISO-processed samples
OXISO処理品

Extended life of punch
〔打抜きパンチの寿命延長〕

Life is considerably extended by applying the special process OX-FSP to the punch.
It can be applied to core pins.

(Purpose)
Improvement of adhesion of coated film.
(Effect)
Mold life is 300% elongated.

打抜きパンチへOXーFSPを利用した特殊処理をする事で、寿命を大幅に延長可能です。
鋳抜きピンにも適用可能。

（目的）
コーティング被膜密着性向上
（効果）
金型寿命 約300%

＜Cut face＞〈せん断面調査〉

SKD11 sharp edge OXISO-processed シャープエッジ OXISO処理			
Sheared plane length せん断面長さ	0.27~0.31㎜(14%UP)	0.34~0.39㎜(34%UP)	0.12~0.15㎜(48%UP)

Application to press dies
〔プレス型への適用〕

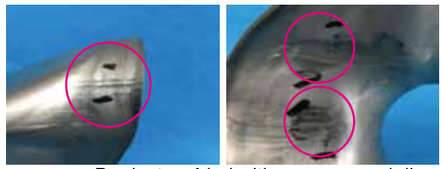
Improving the performance of molding and elongating the lift of dies by the process combinations, OX-FSP+OX-Polish+Ti coating, for press dies.

(Purpose)
・Improvement of moldability => Reduction of defect rate
・Improvement of die life
(Effect)
Die life is improved to about 200% or more.

プレス型へOX-FSP+OX-Polish+Tiコートの複合処理を施すことで成形性向上・型寿命の延長が図れる。

（目的）
・成形性の向上＝不良率の削減
・型寿命の向上
（効果）
金型寿命　約200% 以上。

Application of FSP+Polish+Ti coating to press dies.
プレス型への処理適用FSP+OX-Polish+Tiコート



Product molded with unprocessed dies.
未処理金形成型品

Product molded with processed dies.
弊社処理金形成型品

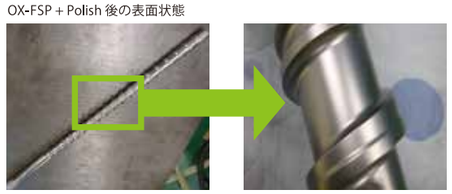
Application to injection molding machine
〔成形機への応用〕

Improvement of sliding performance of internal parts, and prevention of adhesion of resin.

② Reduction of contamination ratio
OX-FSP+Polish process makes separation easy and
remarkably shortens maintenance time.

内部部品の摺動性向上＋樹脂付着の予防
②コンタミ発生率を低減
OX-FSP+Polish処理に依り、樹脂の離型が容易となり
メンテナンス時間を大幅に短縮する事が可能。

Surface condition after OX-FSP+Polish.
OX-FSP＋Polish 後の表面状態



Surface condition after cleaning with purging material
パージ材でクリーニング後の状態

Before process
未加工

Finished sample
加工品

Application-1 to resin molds
〔樹脂金型への適用①〕

Proposals on injection molding machine

① Mold: Elongation of life and improvement of molding performance.
・Mold life elongation effect by OX-FSP process.
・Cost reduction by the improved molding performance.

② Screw cylinder improvement of resin flow performance including 3-a-set.
・Considerable improvement of degassing performance.
・Improvement of resin flow performance.
=> Reducing contaminants = Lowering defect rate.

③ Easy cleaning of resin sticking on molded parts.
・Considerably shortened cleaning hours with Leutor.

射出成型機への提案事項
①金型 寿命延長・成形性UP
・OX-FSP処理による金型寿命延長効果
・成形性の向上により減価低減効果
②スクリュー・シリンダー・3点セット他樹脂流動性の向上
・ガス抜き性を大幅に改善・樹脂流動性の向上
⇒コンタミ発生率低減＝不良率低減
③成形機パーツに付いた樹脂"簡単"にクリーニング
・今までのリューター等でのクリーニング工数を大幅削減
「硬度UP」「残留応用力付与」
⇒金型寿命を大幅に延長可能
「ガス抜き性を向上」「樹脂の流動性を向上」
⇒不良率を低減し＝製造原価低減
☆ウェルドラインの発生も大幅に低減！

・"Hardness UP" and "Deliberate residual stress"
=> Considerably elongating mold life.
・"Improvement of degassing", "Improvement of resin flow"
=> Reducing defect rate = Reducing production cost.
☆ Occurrence of weld line is drastically reduced.

Improvement of molding performance = Excellent quality of appearance.
形成性が向上＝外観品質も良好

Photograph after process.
処理後写真

Application-2 to resin molds
〔樹脂金型への適用②〕

Mold used for injection molding is processed with OX-FSP+OX-Polish to form a plateau on the surface, and that surface improves the moldability and resin separation.

(Purpose)
Formation of a special plateau and improvement of resin separation with smoother surface.
=> Greatly improving resin separation and reducing separation trouble.
(Effect)
Separation trouble is drastically reduced.
=> Improvement of productivity and reduction of defect rate.
=> Contribution to cost reduction.

射出成型金型へOX－FSP＋OX－Polish処理によりプラトー表面（特殊表面）を形成させる事で、成形性の向上と離型性の低減に効果。

（目的）
特殊プラトー表面を形成し、樹脂のスベリ性を向上
⇒離型性を大幅に向上し、離型不良を低減
（効果）
離型不良を大幅に低減
⇒生産性の向上・不良率削減
⇒コストダウンに寄与

Movable core: After OX-FSP+OX-Polish process.
可動コア:OX-FSP＋OX-Polish処理後

Stationary insert: After OX-FSP+OX-Polish process.
固定入子:OX-FSP＋OX－Polish処理後