

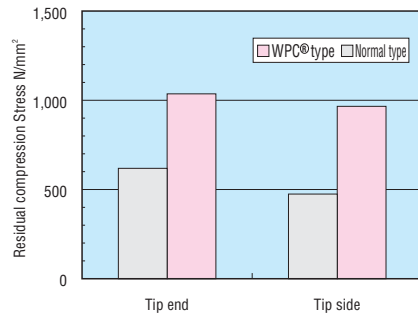
# [PRODUCTS DATA] WPC® • HW COATING PUNCHES

## ■ Features of WPC® PUNCHES

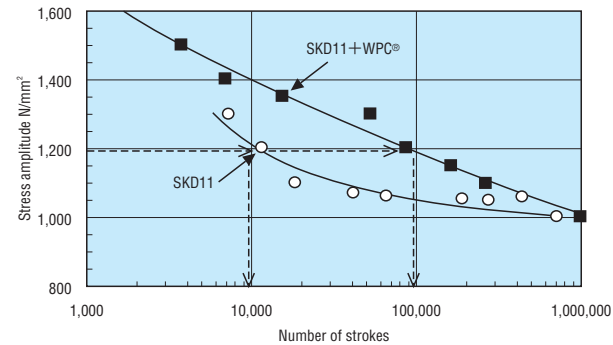
### 1. Fatigue strength improvement

WPC® treatment consists of causing fine particles of between 0.04 and 0.2 mm to collide with the metal surface at a high speed of at least 100 m/s, so a high residual compression stress is generated in the vicinity of the surface of the punch [Fig.1]. As a result, the fatigue strength of the punch is improved, **providing a high resistance to point breakage and chipping** [Fig.2].

For example, in Fig.2 if a load of 1,200 N/mm<sup>2</sup> is applied repeatedly to the point, the SKD11 may fail after about 10,000 operations, however in the case of the SKD11 + WPC® treatment, durability will increase to about 100,000 operations. (The results shown in Fig.2 are different from the actual sampling test results, so use them only a rough guide.)



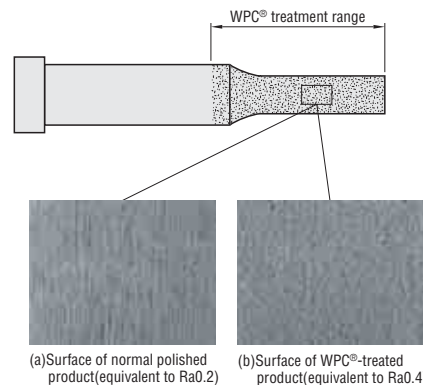
[Fig.1] Surface residual compression stress due to WPC® treatment  
Punch material : SKD11



[Fig.2] Improved fatigue strength due to WPC® treatment  
Load conditions : Pulsating load, Test piece #4, HRC61

### 2. Anti-seizure improvement

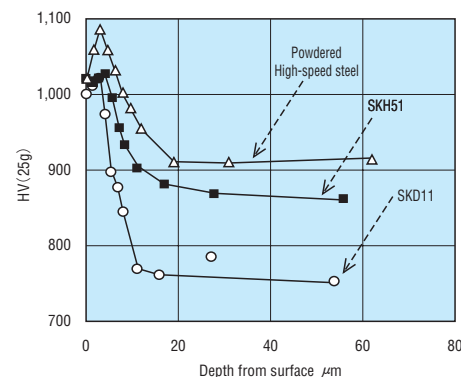
In the case of a normal polished finish, streaks running in the polishing direction remain. In contrast, a surface treated with WPC® has fine surface irregularities [Fig.3]. The fine depressions trap oil, so the WPC®-treated surface retains an oil film more readily than a normal polished surface. As a result, **seizure is less likely to occur**.



[Fig.3] Comparison of normal polished product and WPC®-treated product

### 3. Anti-abrasion improvement

When WPC® treatment is carried out, work hardening occurs, increasing the hardness of the surface. As a result, **the abrasion resistance of the punch is increased**. In the case of a WPC®-treated punch, the surface gradually hardens from the inside [Fig.4], so there is no loss of toughness of the base material of the punch.



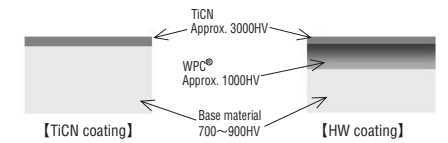
[Fig.4] Hardness distribution near the surface of a WPC®-treated product

Hardness measured using a micro-Vickers hardness tester

## ■ Features of HW Coating

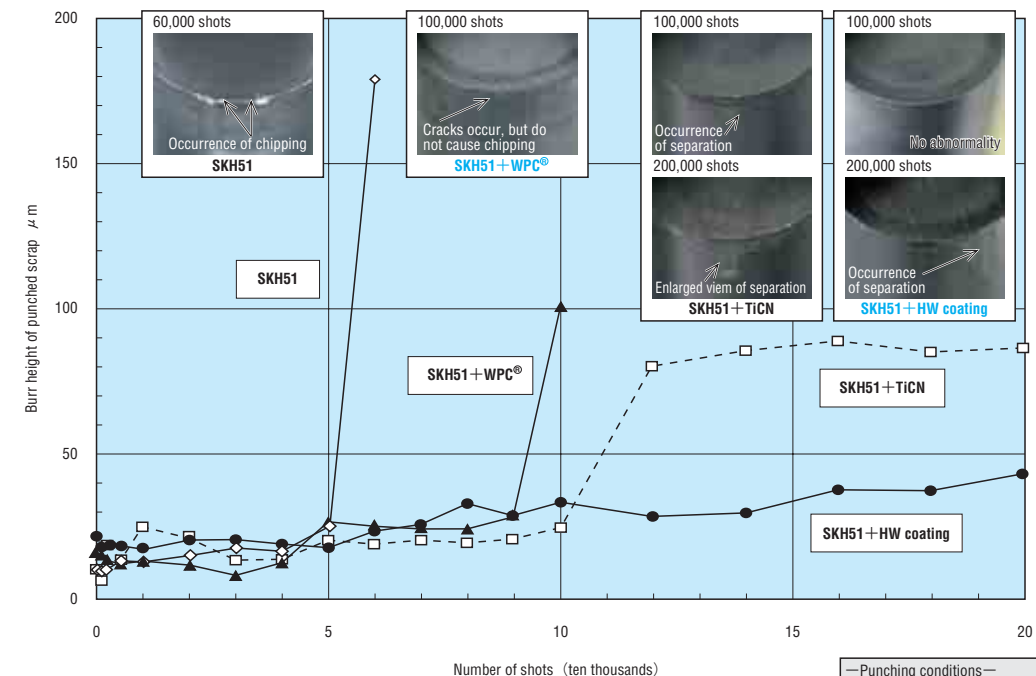
With conventional TiCN treatment, coating separation sometimes occurred under conditions in which a high stress was applied to the punch. It is thought that this trouble occurred because whereas punch base material that is of relatively low hardness deforms, the very hard coated film is unable to follow this deformation.

In the case of the HW coating, the base material of the punch is strengthened by the WPC® treatment, raising the adhesive performance of the TiCN film. The HW coating is a new kind of surface treatment which combines the excellent abrasion resistance of the TiCN coating with the inherent high fatigue strength of the WPC® treatment.



[Fig.5] HW coating and TiCN-coating models

## ■ SUS304 Punching life test



[Fig.6] Change of burr height along with the number of punching operations, and appearance of punch point

—Punching conditions—  
Material to be punched : SUS304, t=1mm, Hv180  
Clearance : One side 7.5%  
Punched shape : φ50mm  
Punching speed : 200SPM

If, for example, the tolerance of the burr height was made 100 µm, the number of punching operations would be nearly doubled compared to when surface treatment was not carried out. Also, it was found that whereas a punch that had not been surface-treated started to chip at the edge of the point after about 60,000 shots, a WPC®-treated punch showed no signs of significant chipping even after 100,000 shots. As a result, it was confirmed that the fatigue strength of the punch point increased due to WPC® treatment.

The TiCN-coated punch and the HW coated punch were both able to withstand at least 200,000 punching operations. However, when the points of both were compared, it was found that after about 100,000 shots, the coating of the normal TiCN-coated punch started to separate, and also the burr height started to increase, but in contrast the coating of the HW-coated punch showed absolutely no signs of separation after about 100,000 shots, and the burr height remained at a low level up to 200,000 shots.

From these results, it was confirmed that the HW-coated punch exhibits superior performance even when used on materials, such as SUS304, that are difficult to machine.