

## PS & PW Salt Bath Nitriding

As a general provider of heat treatment and machining services for various products including dies and molds, jigs and tools, precision machinery components, and magnetic materials, Daido has facilities for performing all types of heat treatment such as vacuum heat treatment furnaces, and our network of domestic heat treatment centers meets a wide range of diverse and advanced user needs.

### Features of PS & PW Treatments

PS (Prevents Scoring and Scuffing) and PW (Prevents Wearing) are salt bath nitriding developed by Daido Die & Mold Steel Solutions.

- PW treated products have enhanced wear resistance, fatigue resistance, and corrosion resistance.
- PS treated have even better galling resistance and welding resistance during hot work processing as a result of the use of special additives in the PW salt bath treatment.
- A deep hardened layer can be formed quickly, creating a nitride layer on molds and dies, jigs and tools, and machinery components that is ideal for the specific application.
- The diffusion layer is deep and the hardness distribution (direction of depth) is good, preventing separation during use.
- The treatment temperature is 570°C or less, resulting in minimal dimension change of treated items made from materials such as hot work die steel and other high-temperature tempered steels.

### Hardness of PS & PW Treatment Layers

The cross sectional distribution of hardness of PW treated items made from various materials (Figure 1) shows that hot and cold work die steel and even carbon steel, which is difficult to nitride, are hardened. As a result, these treatments can be used with various dies, molds, and components to enhance wear resistance. The cross sectional distribution of hardness of a PS treated SKD61 item (Figure 2) shows that there is a layer with the same hardness as the outermost layer, contributing to improved galling resistance.

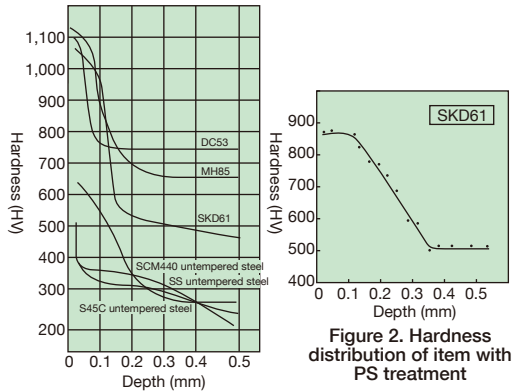


Figure 1. Hardness distribution of various steels with PW treatment

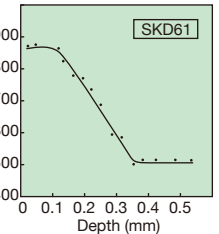


Figure 2. Hardness distribution of item with PS treatment

### Galling Resistance of PS Treated Items

Loads were applied to an SKD61 test piece (a pin) and an SKH51 V block, the pin was rotated, and the change in torque was measured to conduct a Faville test. Based on the results (Figure 3), the increase in torque is low and the torque is relatively stable with PS treated items. In comparison, an SKD61 quenched and tempered item experienced a sudden increase in torque after 30 seconds, and galling started to occur. A component with ion nitriding treatment was also stable at a higher level. The torque of the PS treated component was particularly low and galling resistance effects were exhibited.

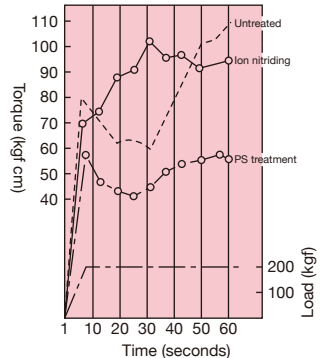
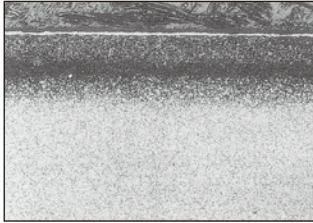


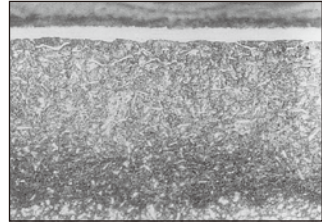
Figure 3. DHA-1 Faville test results

**Optical  
Microstructure**

The figures below show the optical microstructure of an object with PS treatment. (Material: SKD61 heat treated object; conditions: 550°C × 10 hours)



Representative example (× 100)



Representative example (× 400)

**Use Examples  
of PS & PW  
Treatment**

- Hot work press dies
- Die casting molds
- Cold work press dies
- Cutting tools
- Forging dies
- Extrusion dies
- Forming rolls
- Machinery components



**Examples of  
PS & PW  
Treatment  
Effects**

**PS Treatment**

Application/product	Material	Effects
Hot work press finishing die	DHA1	Compared to untreated: about 2 times
Hot work press punch	Foreign material	Compared to sulphurizing: approximately the same
Hot forging die	DH71	Compared to sulphurizing: about 1.4 times
Hot hammering upset die	DH32	Compared to untreated: about 20 times

**PW Treatment**

Application/product	Material	Effects
Cold pressed/sheet metal bending die	DC53	Compared to untreated: about 2 times
Cold pressed/sheet metal blanking punch	DEX20	Compared to untreated: about 2 times
Hot work valve forging die	DHA1	Compared to other salt bath nitriding: countermeasure against internal softening
Fiber processing jig	FC	Compared to other salt bath nitriding: about 1.2 times