Vacuum Heat Treatment

TurboTreater® and Turbo-Vac:
The best in vacuum heat treatment

STC offers premium quality vacuum heat treatment using the latest technology from Abar Ipsen. Our 12 bar TurboTreater® furnace, with convection heating, has enabled STC to gain Ford (FMC) provisional supplier status, recognizing STC as a heat treatment supplier for high pressure die casting applications. The patented nozzle design, cylindrical hot zone and sophisticated computer control gives the TurboTreater® a competitive edge in quenching large workpieces, up to 2200 lbs (1 tonne), reliably and repeatedly.

Our 6 bar Turbo-Vac furnace features convection heating and directional nozzles for through load cooling, giving advantages in uniform quenching of multi-component or slender workpieces.

The benefits of our combined technologies include:
- minimal workpiece distortion
- excellent temperature uniformity (±41°F)
- reduced cycle times - quicker customer service
- metallurgically clean surfaces - eliminating additional processes to remove scale and oxide
- ecologically clean and safe
- reliable, reproducible results due to fully programmable computer control
- QA documentation can be supplied with every furnace batch.
- Choice of radial or directional quenching to suit furnace load.

Heat treatment processes and materials suitable for Turbo-Vac

Surface Technology Coatings specialize in premium quality vacuum through hardening and tempering of high speed steels, hot work steels, cold work steels and martensitic stainless steels and age hardening steels.

The aim is to provide the customer with a heat treated product that has the optimum combination of hardness and microstructure while keeping distortion to a minimum.

Quality Control

Surface Technology Coatings has built its reputation on being able to offer a high quality, reproducible and guaranteed product back to the customer every time. Having the latest testing and analytical equipment, our metallurgical laboratory can process test samples for certification of every process batch. This commitment to quality allows us to be a Quality Endorsed Company (ISO 9001:2008) and meet today’s stringent quality requirements.

Our experienced technicians accurately record all processing parameters and monitor all processing variables. They will work directly with your material, design or manufacturing engineers to determine the optimum processing methods to meet your requirements.
Plasma Nitriding

Surface Technology Coatings introduced Australia’s first commercial plasma nitriding facility in 2002. The revolutionary NitroPlas system generates a plasma on a large cage surrounding the entire workload in a vacuum furnace. The workload is uniformly and efficiently heated by the cage. Problems associated with conventional plasma nitriding, where the plasma is generated on the parts, such as over heating by the hollow cathode effect and damage caused by arcing are thus greatly reduced.

The NitroPlas white layer is hard and tough reducing the need for post-treatment grinding. The nitride precipitates produced in the diffusion zone are smaller and more evenly dispersed than those produced by gas nitriding which considerably improves the toughness and fatigue properties when using NitroPlas.

NitroPlas Benefits
- Reduction of post-nitriding grinding
- Minimal corner and edge chipping
- Minimum distortion
- Reliable, reproducible results every time
- Cost effective
- Environmentally friendly
- Effective masking
- Faster turnaround and reduced down time
- Full metallographic analysis and QA
- Post NitroPlas treatments available

Suitable Materials
- Most alloy steels containing chromium and molybdenum e.g. 4140, 4340
- High alloy steels also containing aluminum, tungsten and vanadium e.g. DIN 1.8550
- Austenitic and martensitic stainless steels e.g. 300 and 400 series
- High speed steels e.g. M2, M42, T15
- Cast irons
- Plastic mold steels e.g. P20
- Sintered or powder metallurgy materials e.g. ASP 23
- Cold work steels e.g. D2, A2
- Hot work steels e.g. H11, H13

Applications
- Aluminum extrusion dies
- Nuts and bolts
- Aerospace components
- Press tools
- Machine tool spares
- Automotive components
- Plastic extrusion and injection molding tools
- Forging dies
- Tool holders
- Valve and pump components
- Shafts and gears
- Rollers
- Ejector pins
- Die casting dies
- Sintered components

NitroPlas plasma nitriding chamber
11,020 lbs (5 tonne) capacity
Chamber Capacity 4 ft diameter x 5 ft high (1.2 x 1.5m)
PVD Hard Thin Film Coatings

Surface Technology Coatings is Australia’s only company providing a combined coating, nitriding and heat treatment service to industry with ultra-hard thin film coatings based on physical vapor deposition (PVD) technology. Using world-leading technology, coatings are available to solve a wide range of problems relating to friction and wear, thereby improving tool performance and increasing tool life.

Tools or components to be coated are first inspected to ensure suitability for coating, and then cleaned using an automatic multi-step process to ensure that they are physically and chemically clean. This is of crucial importance to the success of the coating operation.

Benefits of Surface Technology PVD coatings include:
- Longer tool life - 300% to 1000% increases are typical compared to uncoated
- Increased productivity - tools can be run at higher feeds and speeds
- Uniform thickness - will not alter critical dimensional tolerances of components or parts
- Corrosion resistant - thermally and chemically stable.
  Not affected by most acids and alkalis
- Smoother workpiece surfaces - one half the coefficient of friction of uncoated surfaces results in better surface finish in machining and better mold release in casting operations
- Lower maintenance costs - the significant increase in tool life means fewer tool changes and less down time
- More regrinds possible due to the wear land being significantly reduced on coated tools.

Quality

To ensure the PVD coatings produced at Surface Technology Coatings meet both the requirements of the customer and compliance with ISO 9001:2008 and other applicable standards, full visual assessment of coated items are carried out prior to dispatch of components to customers. As part of Surface Technology Coatings total coating services a continuous program of coating development projects are in operation with various research organizations worldwide to ensure we maintain our high level of coating technology.

To meet today’s stringent quality standards, Surface Technology Coatings has set up a comprehensive range of facilities. These include a metallurgical laboratory and a range of hardness testing equipment. The laboratory has access to optical and electron microscopes as well as a comprehensive range of analytical apparatus for performing routine quality assessments and development work.

PVD Coating Applications

<table>
<thead>
<tr>
<th>Cutting Tools</th>
<th>Forming Tools</th>
<th>Molding Tools</th>
<th>Medical Devices</th>
</tr>
</thead>
</table>
| Drills                        | Punches                        | Plastic Forming Tools:         | Dental Tools
| Taps                          | Dies                           | • Injection • Compression      | Surgical Tools                  |
| Endmills                      | Fine Blanking Tools            | • Extrusion                    | Prosthesis                      |
| Milling Cutters               | Extrusion Dies                 |                                |                                |
| Broaches                      | Forging Tools                  |                                |                                |
| Countersinks                  | Stamping Tools                 |                                |                                |
| Reamers                       | Valve Draw Dies                |                                |                                |
| Router Bits                   |                                |                                |                                |
| Circular Saw Blades           |                                |                                |                                |
| Gear Cutting Tools:           |                                |                                |                                |
| • Hobs • Shaper Cutters       |                                |                                |                                |
| Carbide Inserts               |                                |                                |                                |
| Screw Machine Tools           |                                |                                |                                |
| Circle Form Tools             |                                |                                |                                |
| Component Wear Parts          |                                |                                |                                |
| Fuel Injection Systems        |                                |                                |                                |
| High Performance Bearings     |                                |                                |                                |
| Pump and Compressor Parts     |                                |                                |                                |

INNOVA PVD coating unit
1102 lbs (500kg) capacity
Preconditions for PVD Coatings

Materials that can be coated include carbides, high speed steels, hot work tool steels, certain copper alloys, stainless steels and nitridable alloy steels. Cold work tool steels can be coated if they are tempered at least three times at the maximum secondary hardening temperature. In general all materials that can withstand a coating temperature of 932ºF, without softening or distortion, can be successfully PVD coated. Certain coatings are applied at 1112ºF and these are in general only suitable for carbide substrates.

Brazed parts can also be coated if the brazing material is temperature resistant (melting point >1112ºF) and does not contain cadmium or zinc.

Our first recommendation is that each new application should be evaluated using the combined knowledge of the tool user and coating center specialist to choose the best pre-treatment and coating.

What materials can be coated

- All secondary hardening tool steels.
  - HSS Grades, examples: T-15, M-2, M-35, M-42, ASP Grades
  - Cold Work Tool Steels, examples: D-2, A-2
  - Hot Work Tool Steels, examples: H-13, H-11
- Stainless Steels - 300 series (Austenitic) stainless, 400 Series (Martensitic) stainless, age hardenable Ph stainless (above H-950) examples: 304, 420, 410C, 17-4 Ph.
- Carbide and Cermets - All carbide grades are acceptable.
- Carbide Tipped Tools - can be coated when brazing materials are free of Zinc and Cadmium
Note: Please consult Surface Technology Coatings before sending carbide tipped tools for coating to verify contents of brazing materials.
- Pre-hardened steels, example: P20.
- Miscellaneous - Ampcoloy 940, 945 and others, Beryllium coppers, Titanium and Titanium Alloys, Nickel and Nickel Alloys, Inconels, monels, aerospace and refractory metals and alloys.

Materials that can be coated but may lose hardness

- Heat treated materials such as carbon and low alloy steels with tempering temperatures below 842ºF will lose hardness points due to coating temperatures.

What materials cannot be PVD Hard Thin Film Coated

- Assemblies, tools or parts that are glued, pinned, pressed or screwed together in a fixed or permanent position.
- Any alloy materials which contain Zinc, Tin or Cadmium and other low vapor pressure alloy additions.
- Leaded alloys, fusible alloys and most aluminum, zinc and magnesium alloys having low melting points.

Surfaces that are best for PVD Hard Thin Film Coating

- Fine ground surfaces with a bright finish are best for maximum coating adhesion.
- Ground surfaces should be free of burns, cracking and grinding wheel glazing.
- Free cutting CBN grinding wheels produce excellent surfaces for coating due to lower grinding temperatures.
Tool surfaces that can be coated after specialized cleaning

- Milled or Machined Surfaces
- EDM Cut Surfaces
- Surfaces cut by shaving
- High temperature brazing
- Black or steam oxide surfaces
- Nitrided surfaces
- Polished or lapped surfaces
- Glass beaded surfaces

These surfaces can be successfully coated. However due to varying surface conditions, testing may be required to achieve the best coating adhesion.

Other surfaces requiring special treatment before coating

- Rusted surfaces
- Tools with paint or wax markings
- Tools with layout die or protective plastic coatings
- Chrome plated surfaces
- Nickel plated surfaces
- Used dies or molds should be free of residual material (dry or wet blast)

Conditions on Components

The components must be held for coating; therefore they must have holes, threads or surfaces that can remain uncoated. In order to coat a component all over generally requires two coats and is charged accordingly. It must be possible to mechanically mask surfaces which are to remain uncoated.

Components with internal surfaces (holes, slots) can also be coated. Depending on the geometry of the component, the coating thickness decreases with the depth of the hole or slot. Blind holes and female threads must be free of hardening salts and other contaminants. It is for this reason vacuum heat treatment is strongly recommended when PVD hard thin film coatings are to be applied.

For components that have been previously used in service prior to coating, please inform our staff as out-gassing is required to optimize coating adhesion.

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Alcrona</th>
<th>CrN</th>
<th>Ox</th>
<th>Futura Nano</th>
<th>TiCN</th>
<th>TiN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating</td>
<td>AlCrN</td>
<td>CrN</td>
<td>Steam Oxide</td>
<td>TiAIN</td>
<td>TiCN</td>
<td>TiN</td>
</tr>
<tr>
<td>Coating Structure</td>
<td>Mono Layer</td>
<td>Gradient Coating</td>
<td>NA</td>
<td>Nano Layer</td>
<td>Gradient Coating</td>
<td>Mono Layer</td>
</tr>
<tr>
<td>Coating Thickness*</td>
<td>4 µm</td>
<td>3 - 5 µm</td>
<td>NA</td>
<td>4 µm</td>
<td>2 - 4 µm</td>
<td>1-3 µm</td>
</tr>
<tr>
<td>Micro-hardness</td>
<td>3200 HV</td>
<td>1750 HV</td>
<td>NA</td>
<td>3300 HV</td>
<td>3000 HV</td>
<td>2300 HV</td>
</tr>
<tr>
<td>Coeff. of Friction vs Steel</td>
<td>0.35</td>
<td>0.5</td>
<td>NA</td>
<td>0.3 - 0.35</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Thermal Stability</td>
<td>up to 2012°F</td>
<td>up to 1292°F</td>
<td>NA</td>
<td>up to 1652°F</td>
<td>up to 752°F</td>
<td>up to 1112°F</td>
</tr>
<tr>
<td>Color</td>
<td>Blue - Grey</td>
<td>Silver - Grey</td>
<td>Blue - Black</td>
<td>Violet - Grey</td>
<td>Blue - Grey</td>
<td>Gold - Yellow</td>
</tr>
</tbody>
</table>

*Other coating thicknesses can be supplied on application.