PRESTO INTERNATIONAL UK LTD

TRAINING MANUAL

Part 7

SURFACE TREATMENTS & COATINGS

Surface Treatments

Surface treatments are modifications to the outer surface of the high speed steel cutting tool. The two most common surface treatments used in the cutting tool industry are oxide and nitride.
These two treatments are known as;-

P1 Steam Oxide
P2 Bronze
P4 Nitride

Surface treatments are applied after the tools have been finished. There are three primary reasons for surface treatments;-

1. They act as a lubricant to reduce the friction between the tool and the workpiece
2. They can give a porous layer to hold lubricants
3. They prevent metal to metal contact between the tool and the work piece.

Steam Oxide

This the most commonly used. It reduces the build up or welding of material on work surface. It produces a blue/black finish.
Steam oxide is a controlled form of oxidation (rusting) that actually pits the surface of the work piece. This pitting allows coolant to stay near the surface of the tool. As a result, the life of the tool is extended when used, but not when cutting aluminium materials where a bright finish is required. Steam oxide reduces galling (welding) whilst maintaining high lubricity.

Bronze

A stress relieving treatment usually used on M42 Cobalt materials

Nitride

Nitriding produces a very hard thin shell or "case" around the surface of the tool. This increases the surface hardness, improving abrasion resistance and increasing the life of the tool. This is especially useful when machining abrasive materials, including plastic, copper alloy, cast iron and brass.

Gas Nitride

Similar to nitriding, the gas nitriding gives a deeper penetration for better wear results

Coatings

Coatings are different to surface treatments in that they are applied to the outer surface of the tool. Bonding to the base material. The layer is very thin, typically 2-4 microns.
Coatings significantly improve the wear and tool performance. They provide a barrier that protects the tool against corrosion, wear and high temperatures. They extend tool life, improve the finish of the part being machined and permits increased cutting speeds and feeds, therefore reducing production costs.

Generally coatings are significantly harder than the tool itself. They can extend the cutting life of the tool from 300% to 800% over uncoated tools.

The surface finish is improved through the elimination of welding and galling of small parts of material to the tool during the machining process.

Application of coatings

The two most common methods of applying coatings are Chemical Vapour Deposition (CVD), or hot process, or Physical Vapour Deposition (PVD) or cold process.

Both involve the application of a thin layer of a protective material.

Today approximately 80% of all Carbide tooling is coated but only about 20% of HSS tools are coated.
HSS coatings are applied using the PVD process, which is less than 400°C. This temperature range allows coating without distortion of the tool.

Types of coating

Modern techniques have produced many more coatings but there are three basic common coatings.

TiN	Titanium Nitride
TiCN	Titanium Carbo-Nitride
TiAlN	Titanium Aluminium Nitride
MoC	Molybdenum Sulphide
TiB	Titanium Boride

TiN A gold or yellow coating giving extended tool life. TiN reduces the torque required in tapping and improves productivity.

TiCN Significantly harder than TiN it has excellent lubricity and improved resistance to heat. This results in higher abrasive in materials such as cast iron, brass, iron, aluminium. stainless steel die steel and aluminium alloy. It has a purple finish.

TiAlN This coating is used when machining abrasive materials especially cast iron. Speeds & feeds of HSS can be significantly increased and TiAlN performs very well in materials such as titanium and stainless steel
TiAlN has a bronze colour.

MoC The Molybdenum Sulphide is applied over a previous coating (TiN or TiAlN) and offers superior anti frictional qualities. It is particularly suited for materials which are difficult to machine or where lubricant is not available or in dry machining.

TiB A coating which is excellent on non-ferrous metals. With its high hardness it is particularly useful on materials such as copper, long chipping aluminium (without Si) and on Titanium.