

# Coating catch-up

**Selecting the right cutting tool coating can increase tool life, decrease cycle time and promote enhanced surface finish. SteedWebzell catches up with the ate of the art**

There are continual coating developments, with all of the major cutting tool manufacturers keen to launch coated tools that offer new advantages. For example, Horn's in-house developed TH35 titanium aluminium nitride coating has been developed specifically to combat the problem of built-up edge. This is potentially a major problem in sub-miniature machining applications such as those for which the company's Supermini boring and internal profiling tools are designed. TH35 provides high hardness and oxidation resistance combined with an exceptionally smooth surface. Another recently introduced coating, WNT's HCF 1130, comes into its own when turning high tensile steels, HSS materials and chrome-nickel steels. WNT says that this new coating can reduce massively the friction between insert and workpiece.

Also, the

multi-layer composition of the HCF coating delivers a high elasticity that has the effect of damping cutting forces.

Within the same family of inserts, WNT has introduced its HCF 3110 grade which, while visually the same as HCF 1130, has been developed specifically for machining cast iron. The combination of the friction-reducing and multi-layer attributes of the coating combined with a K10 carbide substrate provides a competitive alternative to ceramics.

"The move to PVD coating technology in the production of cutting inserts has resulted in edges that are much 'sharper' than can be achieved with CVD," says Adrian Fitts, WNT (UK)'s business development manager. "This is ideal for applications in stainless and high alloy steels." WNT says it will continue to introduce innovative coatings for its range of cutting tools, placing emphasis on the relationship between the coating and the carbide substrate. It is fully expected that parting and grooving systems will

be next to benefit from PVD coatings.

WNT is part of the Ceratizit consortium, which itself is recognised as a pioneer in coating, a recent case in point being HyperCoat technology, which features a particular resistance to heat and a low tendency to stick. HyperCoat combines optimised carbide substrates with multi-layer CVD coatings and an innovative final surface treatment to improve the surface properties, cutting edge protection and wear resistance of the insert.

## NANO LAYERS

According to Sumitomo Electric Hardmetal, today more than 80 per cent of turning operations and 50 per cent of milling applications are performed with coated carbide, cermet and CBN tools. This has led the Japanese to develop super fine levels of coating through the application of nano-technology principles. The thickness of each of the coating layers – over 2000 of them – totals less than 3 micron.

Already a Sumitomo standard, the Sumitomo ZX coatings have a film-like thickness that allows cutting edges to remain sharp after the coating process, enabling high shear geometries to form part of the insert design that reduces cutting force and permits higher feed rates on lower powered machines using higher feed rates.

The ZX coating is 4000 Hv, almost as hard as CBN which itself is almost as hard as diamond, yet Sumitomo's latest

*Walter's PVD Tiger.Tec provides a wear-resistant, defined cutting edge, and maintain a controllable edge temperature*



## Coating types

Today's coatings are typically applied using PVD (physical vapour deposition) or CVD (chemical vapour deposition) techniques. Common coatings include:

- ☐ Titanium nitride (TiN) – a general purpose PVD coating that increases hardness and has a high oxidation temperature
- ☐ Titanium carbo-nitride (TiCN) – the addition of carbon adds more hardness and better surface lubricity
- ☐ Titanium aluminium nitride (TiAlN) – a formed layer of aluminium oxide gives this tool better life in high heat applications
- ☐ Chromium nitride (CrN) – the anti-seizure properties of this coating make it preferred in situations where built-up edge is common
- ☐ Diamond – a CVD process that offers the highest performance available for working non-ferrous materials such as graphite, metal matrix composites and high silicon aluminium.

nano-technology coating is called Super ZX, which has a hardness value of 5300 Hv. Super ZX is a multilayer PVD coating that is formed using thousands of alternate titanium aluminium nitride and aluminium chromium nitride film layers. Compared with common titanium aluminium nitride coats, this new PVD coating offers improved hardness and oxidation resistance.

Another new coating from Sumitomo, the Super FF, is a smooth multilayer thin film structure comprised of titanium carbo-nitride and aluminium oxide film. This gives a higher resistance to chip adhesion and edge wear than conventional CVD coatings. Super FF coated grades are recommended for cast irons and ductile irons

### DIAMOND LIKE CARBON

Other new coating developments at Sumitomo Electric Hardmetal include DLC (diamond like carbon) for the dry machining of aluminium using its Wavemill Auroracoat inserts. DLC is an amorphous film that is more like carbon than diamond. It is a hard, thin film that features high hardness, superior tribology properties and excellent adhesion resistance. It has a low friction coefficient when used without lubricant.

Many machine shops will be interested in sourcing a solution that

covers a range of machining tasks. One supplier offering an 'umbrella' solution is Sandvik Coromant – its new GC4225 insert grade is able to machine steels in the P25 spectrum from low carbon through to high alloy. Durability is improved, partly through the insert's ability to better withstand both thermal demands and physical variations. This is achieved by removing the gold TiN coating, which has a number of additional benefits. These include the reduction in built up edge, improved resistance to coating flaking and increased edge line toughness. All these advantages combine to make it more suitable for wider application within the broad area of general steel turning, including extremely tough automotive crankshaft forgings, where Sandvik tests show highly advantageous results.

Also new from Sandvik is its versatile GC4230 insert grade, which is optimised for light to heavy milling of alloyed and unalloyed steels. Sandvik says that "stressless" coating technologies help ensure this new grade brings improved edge line toughness far beyond standard CVD grades.

At Walter, recent emphasis has been on the development of what it calls the world's first PVD aluminium oxide

coated carbide (PVD-AL2O3).

Traditionally, aluminium oxide could only be applied with the CVD process at high temperature, efficient for plain carbon materials but compromised when cutting chrome or nickel alloys due to loss of cutting edge definition and high cutting temperatures. Walter's PVD-AL<sub>2</sub>O<sub>3</sub> Tiger.tec inserts provide a wear-resistant, defined cutting edge, while maintaining controllable edge temperature.

Also utilising a basic AL<sub>2</sub>O<sub>3</sub> aluminium oxide structure is Seco's new TP2500 turning grade, which is applied using the company's innovative "Duratomic" process. The grade is targeted at P15-P30 applications, as well as stainless steel turning and cast iron turning,

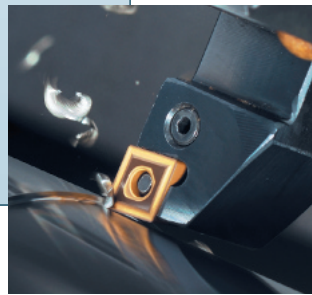
effectively machining in the M20 and K30 application areas.

### ATOMIC MANIPULATION

Seco's Duratomic process (insert, above) employs new process methods and crystallographic control to manipulate the coating at the atomic level. Duratomic grew out of Seco's search to develop a grade with a new level of wear resistance and toughness, two characteristics that have always been diametrically opposed.

The IMC Group includes Iscar, Ingersoll and TaeguTec, so its president Jacob Harpaz is an important voice in the cutting tool sector and he has his own opinions on the subject of coating trends.

"PVD tooling now accounts for 56 per cent of global cutting tool consumption as opposed to 20 per cent in 2000," he says. "Uncoated cutting tools are set to disappear as there is now no real need for them. Why do customers still use HSS? There are new generations of coatings that can be PVD applied to maintain sharp edges on tooling – this leaves no excuses." ☐



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