

APPLICATION NOTE

Determining coating thickness on PVD-coated tools

High-precision industrial saws, drills and dies used for the cutting, punching and forming of steel, hard metal or aluminium parts are subject to extreme wear and tear. To increase the service life of these often very expensive tools, they are coated with a hard material coating via a PVD (physical vapour deposition) process. The thickness of the PVD layer determines the durability and therefore the life expectancy of the tool. Tool and die makers must therefore guarantee a minimum coating thickness, requiring high-precision control measurement technology.

PVD coatings are physically spattered onto workpiece surfaces in a vacuum furnace. For this purpose, the tools are carefully stacked in a chamber which is then evacuated and heated. Next, the entire setup is bombarded with ions (such as titanium or chromium). With the addition of gases such as nitrogen layers like TiN, CrN, TiCN, etc., are thus evenly deposited onto the tools. Sophisticated workpiece holders within the furnace guarantee that the layers are deposited as evenly as possible over the tools' entire surface.

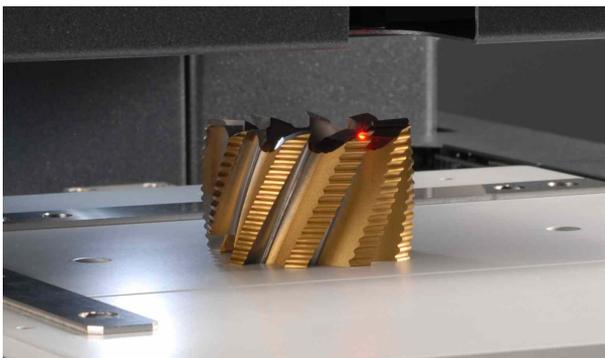


Fig. 1: PVD-coated tool

Specific process parameters such as vacuum, temperature, ion beam intensity and duration determine the layer deposition process and result in the required thickness. As with all types of coatings, the PVD process must also be closely monitored and the thickness of the PVD-deposited layer measured. Alongside standard

destructive testing methods, the non-destructive X-ray fluorescence method (XRF) has found broad acceptance for this purpose. The FISCHERSCOPE® X-RAY XDLM, with its robust design concept, is optimised for these requirements as it combines the high-intensity beam of a micro-focus tube with a small aperture and large detector window. The salient advantages of this device are:

- Non-destructive measurements, no damage to valuable workpieces
- Fast measurement times
- Smallest measurement spots: 100 µm

The instrument's specialisation for this purpose means that layer thickness can be accurately measured on even the finest cutting edges of very high-end tools. Furthermore, using the same instrument, it is possible to determine the base tools' precise metallic composition – e.g. to determine Cobalt leaching when an old coating is chemically removed before a new coating is applied.

TiN-coating on HSS tools	Coating thickness
Single measurement readings	3.53
	3.62
	3.53
	3.48
	3.62
	3.54
	3.60
	3.49
	3.56
	3.61
Average (10 measurements)	3.56 µm
Standard variation	0.05 µm
Coefficient of Variation	1.47 %

Tab. 1: Example for a TiN coating on HSS tool steel, measured with 10 s measurement time, collimator 0.1 mm on FISCHERSCOPE X-RAY XDLM

To determine the thickness of hard coatings on tools and for quality monitoring of the PVD coating process, the FISCHERSCOPE® X-RAY XDLM is the optimal measurement system. For more information, please contact your local FISCHER representative.