

APPLICATION NOTE

Application of FISCHER products

AN054en

Determining the mechanical properties of hard coatings used on machining and milling tools

Hard coatings are used for many industrial purposes. Especially for machining and milling, the tools used are made with hard-coated cutting materials. Depending on the application area, specialised coating solutions have been developed to enhance abrasion resistance and, therefore, durability. Controlling the quality of these coatings according to distinct material properties such as micro-hardness is a tough challenge for most measurement technologies.

Typically, machining tools like drill bits and indexable inserts are protected against abrasion by hard coatings, since the hardness and viscosity of the cutting edge are defined by the coating, not the softer substrate. But coatings applied by physical or chemical vapour deposition (PVD or CVD) such as titanium nitride (TiN) are often only a few micrometres thick, making it very difficult to determine their material properties via classic hardness measurement methods. However, the instrumented indentation test ("micro-hardness testing") enables accurate measurement even on very thin coatings (requiring very shallow indenter penetration depths) while still preventing any influence of the substrate on the readings. The FISCHERSCOPE® HM2000 operates according to this measurement principle, accurately determining not only the Martens hardness (HM) of the layer but also other parameters, such as elastic deformation.



Fig. 1: Variety of hard coated inserts

The instrument's integrated microscope allows exact positioning even on small shapes. Since the coating process generates a rough surface, it is recommended to repeat the measurements several times in order to yield a meaningful average value; the HM2000's precise positioning stages make it straightforward to program and automatically reproduce these measurements. Typical results for hardness determination of the TiN coating on a drill bit are shown in Figure 2.

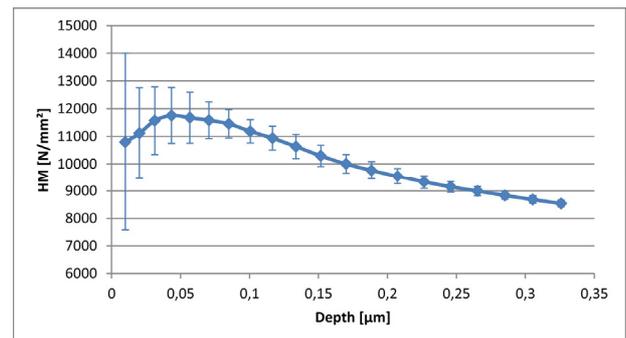


Fig. 2: Depth dependent Martens hardness of a 1 µm thick TiN coating. Starting at one-tenth of the layer thickness the measurement results are influenced by the base material (Bückle rule).

The standard deviation reflects the degree of surface roughness on the coating. But despite the roughness, the repeat measurements make it possible to characterise the coating's hardness exactly. Between the easy sample preparation and its intuitive handling, the FISCHERSCOPE® HM2000 ensures quick and efficient micro-hardness testing on such hard, thin industrial coatings.

For the exact determination of essential wear resistance properties, such as hardness or ductility, of the hard coatings on machining and milling tools like drill bits or inserts, the easy-to-use FISCHERSCOPE® HM2000 is the right instrument. For further information or sample measurements, please contact your local FISCHER representative.