

Special cutting-edge geometry ensures a high surface quality

Stainless steel is difficult to machine and thereby rapidly wears out special tools. In case of an end mill, a special nano coating as well as cutting edge geometry with unequal helix angles provide an optimal chip removal thereby ensuring lesser wear and tear and enhanced process reliability. By Iris Gehard

The properties of stainless steel, such as greater adhesion tendency and ductility as well as reduced thermal conductivity, mean that the material is difficult to machine even with special tools which will wear out relatively quickly anyway. Furthermore, there is a pronounced burr formation on the work piece and the desired surface quality can often not be achieved. In order to improve the process reliability for machining of stainless steel, Wexo has developed an end mill with X-Top 400 in which the cutting edge geometry and cutting parameters are optimised in such a manner that a particularly high surface quality is achieved with Ra values of about 0.4 µm. Almost burr-free material edges can be produced, the company claims.

Unequal helix angles allow better chip removal and contribute to increased smoothness of solid carbide milling cutters. Moreover, the nanocomposite coating distinguishes itself by a high thermal stability and a thick layered structure with good sliding qualities. The wear and tear on the work piece is thereby reduced and the service life is clearly increased.

Smooth surface of the coating and high thermal stability

Since stainless steel is mostly used in harsh environments – for e.g., in valves, fittings or pumps – it must be highly resistant to corrosion and must demonstrate a distinct mechanical strength under high temperatures. However, these are precisely the qualities that work against good machinability and complicate the machining of special tools. “Compared to other steels, stainless steel, for example, has a greater adhesion tendency and thus gets stuck more easily to the tool”, explains Björn Hamel, Product Manager at Wexo Präzisionswerkzeuge.

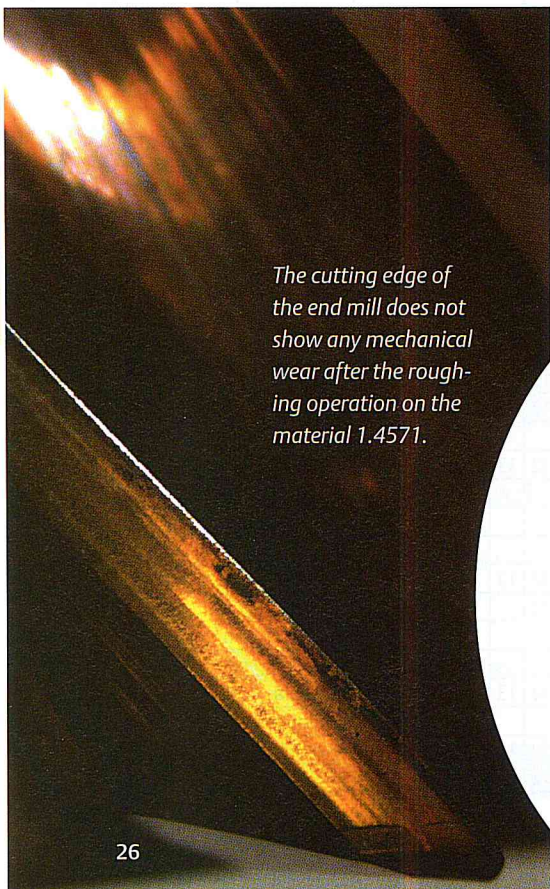
“To counteract this, the milling cutter must be provided with a surface coating on which as little material as possible is set”.

A special TiAlN-TiSiN coating, thus specially developed for the end mill which forms a very smooth surface of the coating with good adhesion properties. An optimal chip removal is guaranteed while processing work pieces. Moreover the nanocomposite coating has a particularly high thermal stability. “That is also an important factor for process reliability since stainless steel has only a low thermal conductivity. The heat originating during processing must also be compensated by means of the tool,” according to Hamel.

Furthermore, the material indicates a greater ductility than normal steel. The special cutting-edge geometry of the end mill was designed in such a way that it increases the toughness of the material which in turn supports chip formation. The end mill also has an unequal helix angle: “The opposite edges respectively have an angle of 39° or 41°. While milling in the pockets, the tool thus operates considerably more quietly than a same-angle tool. The chip removal also improves the result,” explains Hamel.

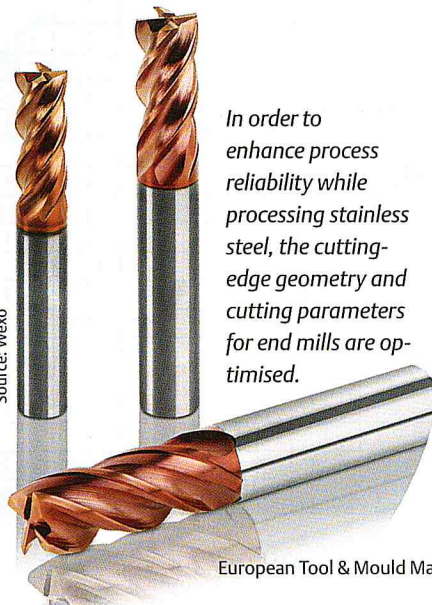
Stainless steel is also difficult to machine because the basic stability of the material is clearly increased as a result of the heat produced in processing. In all, while milling austenitic stainless steel and duplex stainless steel it leads to increased notch wear and cutting chipping. In order to avoid this, the cutting-edge geometry of X-Top end mills was designed in such a manner that it counteracts this effect, Wexo says.

Source: Wexo



The cutting edge of the end mill does not show any mechanical wear after the roughing operation on the material 1.4571.

Source: Wexo



In order to enhance process reliability while processing stainless steel, the cutting-edge geometry and cutting parameters for end mills are optimised.

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