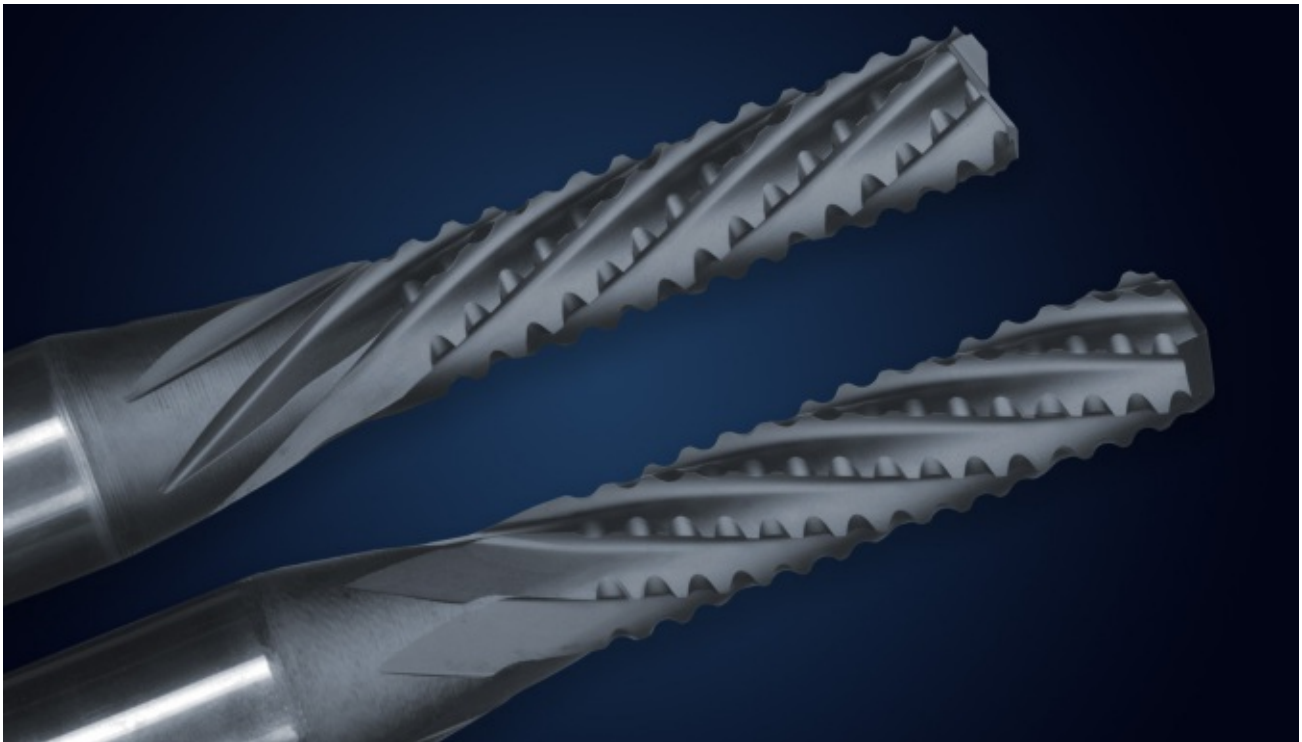


Long tool life and best surface quality



The new micro-milling cutters "HPTec Composite Tool Action" (top: downcut geometry; bottom: upcut geometry) have been precisely adapted to the machining of fiber composite plastics. An important component is the diamond coating based on CCDia®AeroSpeed®.

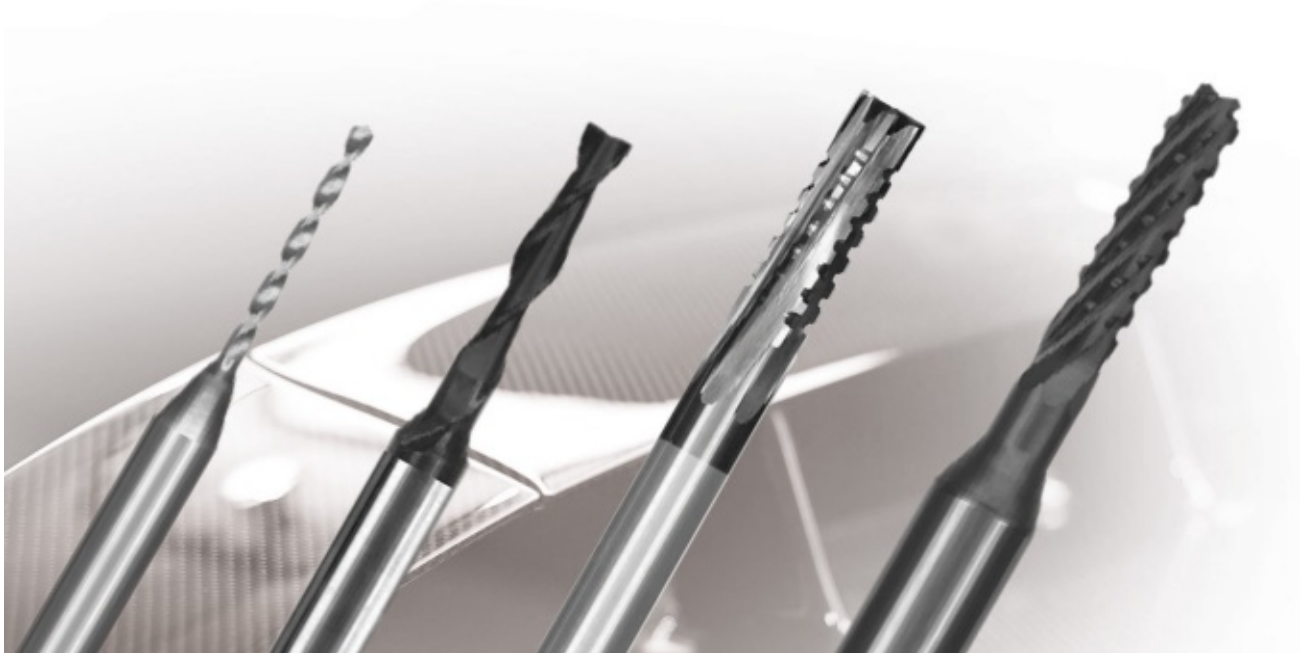
HPTec Composite Tool Action with CCDia®AeroSpeed®

Because of their low weight and high load-bearing capacity, fiber composite materials (FRP) are being used in more and more applications. HPTec GmbH from Ravensburg is one of the world's leading specialists when it comes to the anything but simple machining of such high-performance materials. With a view to highest process reliability and component quality, the tool experts have developed the new micro cutters of the "HPTec Composite Tool Action". An important component is the diamond coating based on CCDia®AeroSpeed®.

Composites such as CFRP or GFRP consist of several layers. The specific combination of fibers, such as carbon or glass, with different resins or bonding agents, such as Kevlar, aramids or polyester, enables the design of complex components with high strength and low weight. This inhomogeneous material structure with hard and highly abrasive fibers as well as a thermally sensitive matrix poses special challenges for machinists. Reliable process solutions are required that also meet the increasing demands on productivity.

"Delamination and fiber protrusions weaken the structure of FRP components. Therefore, they must be avoided at all costs during machining. A high cutting edge quality and the wear resistance of the cutting

material play a decisive role in this. Carbide tools with diamond coating have proven to be the best approach for reliable and economical machining. The substrate, geometry and coating must be perfectly matched to each other. In addition, very low cutting forces massively reduce delamination and fiber residues. Small tool diameters with optimized geometry reliably counteract workpiece damage," says the Head of Sales MCT (Micro Cutting Tools) at HPTec GmbH, describing the requirements for the development of a precision tool for machining FRP.



The MCT (Micro Cutting Tools) and MCT UP tool program includes micro tools with diameters from 0.05 to 10.00 mm for a wide range of materials, such as precious metals, steel, ceramics, CFRP and GFRP as well as non-ferrous metals.

Test winner: CCDia®AeroSpeed®

When developing tools for trimming or contour milling of thin-walled FRP workpieces, the goal for HPTec was clearly defined: A smooth surface was to be achieved - without fiber residues, delamination or component damage, and with maximum cutting force reduction. The results are the new micro-milling cutters "HPTec Composite Tool Action" with diameters from 1 to 3 mm. As the Sales Manager explains: "Thanks to the special toothing or chip breaker profile and six cutting edges, we reduce the cutting forces by up to 80 percent. The small helix angles reduce the tensile and compressive forces and thus also critical vibrations. We have selected an ultra-fine-grain carbide with a very high flexural strength for high process reliability as the cutting material. In order to find the best possible coating for our matched micro tools, our development team carried out numerous laboratory tests. One diamond coating clearly stood out from the others and delivered excellent results: CCDia®AeroSpeed® from CemeCon."

CemeCon matched the multilayer coating material exactly to the processing of composites and adapted it to the new tools in close cooperation with HPTec. With its extremely smooth and ultra-fine crystalline surface topography as well as excellent adhesion, CCDia®AeroSpeed® ensures very good chip flow and quickly conducts the frictional heat out of the contact zone. This significantly reduces thermal stress and avoids delamination. With a hardness of around 10,000 HV0.05, the coating is highly

resistant to the high-strength and highly abrasive fibers, thus ensuring long tool life. Due to the patented multilayer structure, the diamond coating has crack-stopping properties. This leads to significantly higher process reliability. "Particularly with small tools, it is important that the coating does not affect the filigree geometry and that the cutting edges are unintentionally rounded. For optimum wear protection, we have chosen a coating thickness of 9 µm for HPTec milling cutters. Nevertheless, the milling cutters coated with CCDia®AeroSpeed® have sharp cutting edges and thus separate the abrasive fibers much better than with conventional diamond coatings. There are no fiber protrusions and the excellent quality of the milled surfaces can be reproduced at any time," adds Manfred Weigand, Product Manager Round Tools at CemeCon.

Perfectly matched for excellent results

"Micromachining is a complete system in which each component is matched to it in order to achieve the highest possible dimensional accuracy, surface quality and very long tool life. - This also includes, for example, the machine spindle and tool holder. That's why we also support our customers in optimizing their processes," says the sales manager. "Because this is the only way our high-performance micro-tools such as the new micro-milling cutters for machining fiber-reinforced plastics can achieve the best results!

HPTec GmbH

HPTec GmbH is an internationally operating medium-sized company with its headquarters in Ravensburg. It develops, produces and markets drilling and milling tools made of hard metal for machining a wide variety of materials, such as precious metals, steel, ceramics, CFRP and GFRP as well as non-ferrous metals. For about 40 years, HPTec has been building up its competence in microtools for the PCB industry in a determined and user-oriented manner and has become the European market leader in this field. For some years now, HPTec's customers have also increasingly included companies from the watch and jewelry industry, aerospace, medical and dental technology, automotive and the optical industry. The MCT (Micro Cutting Tools) and the MCT UP tool program includes micro tools with diameters from 0.05 to 10.00 mm. Innovative and specially adapted tool geometries, tightest manufacturing tolerances and 100 percent quality control along the entire manufacturing process ensure highest precision and efficient machining. In close cooperation with leading material and machine manufacturers as well as in research projects with external partners, HPTec's experts develop strategies and tools to optimize productivity and quality in their customers' manufacturing processes.

<https://www.ssl-hptec.de/>

Faserverbundkunststoffe ■ Mikrofräser ■ Micro tools ■ CCDia® AeroSpeed® ■ Abrasion ■ Matrix ■ Delamination ■ Faserüberstände ■ Hohe Schneidkantenqualität ■ Wear resistance ■ Glatte Oberfläche ■ Multilayer-Schichtwerkstoff ■ Spanfluss ■ Frictional heat ■ Thermal stability ■