

Machining

## Cutting More Than Just Metal

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Global manufacturers and technologists are constantly searching for production improvements and investigating the use of different kinds of materials to make their products more attractive to the market. To achieve these aims in a rapidly changing world, all concerned need to be more flexible and willing to embrace change.

The use of a growing number of nonmetallic materials is now rapidly increasing and many applications previously considered to be the domain of more traditional materials are now manufactured from nonmetallic materials. The use of composite materials and CFRP (carbon fiber reinforced plastics) is now relatively common and the market share of these materials continues to grow.

As one of the leading companies involved in the metal cutting industry, ISCAR ensures that its prolific R&D department continues to innovate and develop a range of advanced cutting tools that are specifically designed for the efficient work of CFRP and composite materials. These progressive products provide our customers with very effective manufacturing solutions related to these challenging materials.



As one of the leading producers of cutting tools for the metalworking industry, ISCAR boasts a wide range of high-performing, precision-engineered polycrystalline diamond (PCD)-tipped tools.

Over the past three decades, composite materials, plastics, ceramics and the myriad of materials covered by the term CFRP have been the dominant emerging materials. Composite materials continue to relentlessly penetrate and conquer new markets and the number of applications for these materials continues to grow. Now, modern composite materials constitute a significant proportion of the engineered materials market and are used in applications from everyday products to more sophisticated niche areas.

Industrial leaders, such as the automotive, aerospace and power industries, lead the way. For example, modern commercial-sized turbines typically use three-bladed designs. These blades are manufactured from fiberglass-reinforced polyester with an epoxy resin binder. New materials, such as carbon fiber, are continually being introduced, which provide the high strength-to-weight ratio needed for these large wind turbine blades. Now, the length of a typical turbine blade used on 5 MW machines can reach 60 meters.

**For many applications, its high strength-to-weight ratio makes CFRP the preferred material in the global aerospace and automotive industries.**

Composite materials are increasingly being used in all aspects of our daily life, such as in sports equipment, cars, motorcycles, consumer goods and health care products. An example of use within the medical field is the new method used for the reconstruction of large or complex-formed cranial bone defects. In this area, pre-fabricated, computer-generated, individual CFRP medical grade implants are now used.

It is vitally important for the world's manufacturers and technologists, involved in almost every industry, to be prepared for the new requirements of the market and be flexible enough to find new applications for CFRP and composite materials.

As one of the leading producers of cutting tools for the metalworking industry, ISCAR boasts a wide range of high-performing, precision-engineered polycrystalline diamond (PCD)- and cubic boron nitride (CBN)-tipped tools. ISCAR also has a variety of advanced diamond-coated solid carbide tools with a range of geometries to meet the most exacting demands of today's metal, wood, CFRP and composite material industries. These products include inserts, countersinks, ball mills and mills, profile cutters and combined drills, step reamers and a drill with countersinks. Also, our highly experienced engineering team welcomes requests for "special" tools for the machining of any kind of material.

PCDs are in increasing demand for more efficient machining of modern materials, such as nonferrous metals, plastics, composite material (graphite) and other hard-to-cut or abrasive materials. CBN tools are required to machine hardened steels above HRC 45, cast iron, super alloys and other specific metals. High-quality tools increase productivity and save production costs. ISCAR's R&D resources are committed to helping solve the problem of machining these complex materials, and a significant amount of money is continually being spent on developing an even wider range of solutions.

The machining of materials which are currently used for advanced types of aircraft demands new processes as these difficult materials are lightweight, yet very strong. The tooling commonly used for machining CFRP features long-lasting diamond PCD inserts, vein PCD milling tools or brazed mandrel tools.

When machining composites such as CFRP, there are virtually no chips created. Instead, the material removal mechanism might be better described as 'shattering.' The impact of the cutting edge fractures the hard carbon fibers, rather than shearing material away. This process causes considerable abrasion to the tool's cutting edge, leading to rapid wear. In composite machining, as well as any other cutting tool application, tool geometry drives cutting performance. However, in the area of composites, tool material also becomes a major driver of performance. Unless the tool's edge material is able to withstand high levels of abrasion well enough to hold its geometry and stay sharp, the tool can wear so quickly that the geometry can change rapidly. In order to successfully machine CFRP, ISCAR has developed hard, sharp solid-carbide tools which are coated with long-lasting diamonds.

The diamond coating used is commonly a polycrystalline diamond (PCD) coating. However, a diamond coating applied by the chemical vapor deposition (CVD) process is the only coating that utilizes 100% real diamond crystals. A major advantage of CVD diamond coating is that it reduces the heat and friction created by the highly abrasive composite material.

Although the machining operations required for composite parts may be simple (sometimes only drilling and trimming), the fixtures designed to support these often complex parts can represent small feats of engineering in themselves. Thus, the fixture for machining a composite part can be a considerable engineering investment. Clean cutting without fraying, delamination or otherwise separation of material layers requires the part to be firmly secured against vibration.

ISCAR's high-quality, precise PCD- and CBN-tipped and diamond-coated tools reduce users' production costs and improve the quality of manufactured products. Considerably improved performance on CFRP and composite materials is guaranteed when compared to the use of comparative tungsten carbide tools. Also, higher precision and excellent surface finish characteristics are achieved.

ISCAR is known throughout the industrialized world for excellent customer service, quality of products and cost-effective price, not just in the area of metal machining, but also in the field of CFRP and composite working.

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