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Technical Article

Soaring to New Heights: Extending Tool Service Life in CFRP-Aluminum Stack Drilling

An innovative solid carbide drill design with CVD diamond coating achieves 130% longer tool service life in composite machining.

Drilling thousands of rivet holes with consistent precision into CFRP-aluminum composite aircraft components demands top-tier solid carbide (SC) drills engineered to perfection. Scheinecker, a leading Austrian manufacturer of "Made in Austria" precision tools with 50 years of experience, delivers exactly that in the shortest possible time. In a recent project, the company increased tool service life by 130%, significantly exceeding customer expectations – and a key contributor to this success was the BALDIA COMPOSITE DC CVD diamond coating from Oerlikon Balzers.

Carbon fiber reinforced polymers (CFRPs) are widely used in lightweight aerospace construction – but they pose a challenge for machining experts. As a drill passes through a composite, it encounters alternating layers of ultra-hard carbon fibers and softer epoxy resin. In stacked materials, it may also cut through titanium or ductile aluminum, each with vastly different machining properties. The primary goal is to avoid delamination – fiber breakout at the drill's entry and exit points – which can lead to inconsistencies in hole diameter, shape and surface finish. This is a major problem when there are thousands of rivet holes that ensure structural integrity.

This is where Scheinecker, celebrating its 50th anniversary in 2025, brings 35 years of aerospace machining expertise to the table. "We analyze every application in detail, on site with the customer, before we even begin designing the tool," explains Dino Lirk, Technical Director at Scheinecker.

This was the approach taken by Scheinecker when a major aircraft manufacturer asked them to develop a drill that could outperform the current tool after a material change. The new stack consisted of multiple CFRP and aluminum layers used in wing components of a passenger aircraft. To machine these heterogeneous materials reliably while ensuring a long tool service life, the substrate, geometry, micro cutting edge structure and coating must work in perfect harmony. Scheinecker's design focused on chip flow, controlled chip breaking and tool stability, and it also optimized the surface finish, concentricity and drill rigidity.

Enhancing Tool Performance with BALDIA COMPOSITE DC

Knowing that the coating plays a decisive role in performance, Scheinecker turned to BALDIA COMPOSITE DC, a diamond coating from long-time partner Oerlikon Balzers. Specifically developed for composite

machining, this nanocrystalline CVD (Chemical Vapor Deposition) coating protects against wear from highly abrasive CFRPs, thermal stress, aluminum adhesion and burr formation.

The diamond coating grows with micrometer precision on the tool, and the coating thickness is carefully controlled within the required tolerance limits. This enables extremely tight tolerances for both tool diameter and hole quality. Specialist pre-treatment further preserves sharp cutting edges, ensuring high process reliability and consistent bore quality.

Scheinecker designed the SC drill for use in a semi-automated Advanced Drilling Unit (ADU) – a first, as these components had previously only been drilled manually. The geometry and drill were measured and manufactured with high precision using state-of-the-art equipment, and testing was conducted both in-house and at the customer's site.

130% Longer Tool Service Life in Just Four Weeks

The first test produced 600 holes – now the tool exceeds 1,000. "With 1,000 holes, we're already 130% above the customer's requirements. With further optimization of coating thickness and geometry, we expect up to 30% longer tool service life," says Lirk. From initial inspection to final delivery, the entire process took just four weeks – the standard lead time at Scheinecker. "The industry average is over ten weeks," he adds. Working closely alongside Oerlikon Balzers allowed the project to be implemented quickly and tool service life to be significantly extended. "In projects like this, we immediately gather all relevant parameters and quickly determine the optimum coating and thickness based on our experience. Scheinecker supplies all the necessary data early on, allowing us to coat and deliver test tools in a very short time," explains Dirk Schmidt, Product & Key Account Manager Diamond at Oerlikon Balzers.

"This is why we work exclusively with Oerlikon Balzers as our coating partner," says Ulrike Scheinecker-Graul, Managing Director at Scheinecker. They were in no doubt that this partnership has been a success, calling the cost per hole achieved with the high-efficiency drill the best result they have ever seen in a project of this kind.

About Scheinecker GmbH

Founded in 1975, Scheinecker is a family-owned company based in Steinhaus near Wels, Austria. It specializes in the development and production of productivity-enhancing solid carbide cutting tools for industries including mechanical engineering, mold and die making, medical technology and plastics injection molding. For over 35 years, the company has focused on innovative solutions for machining materials such as carbon, GFRPs/CFRPs, aluminum and titanium in the aerospace sector. Through tool reconditioning, advanced technologies and heat recovery systems, Scheinecker actively contributes to sustainability and climate protection.
www.scheinecker.info

Image 1

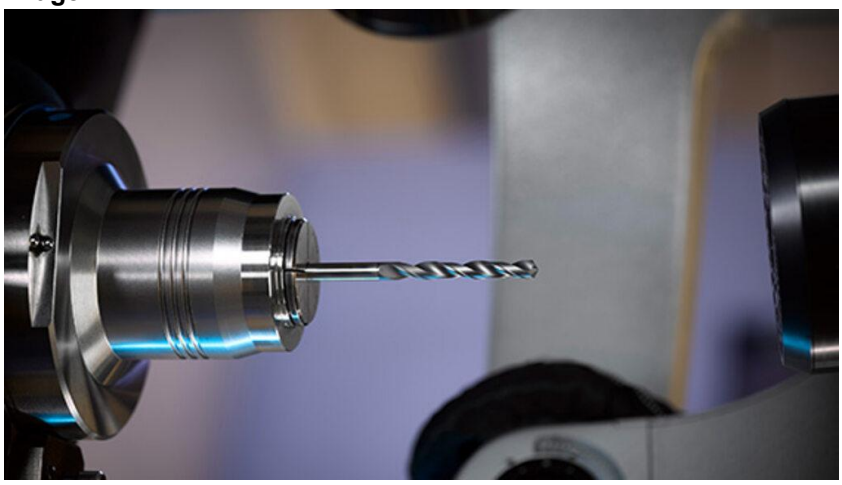

Photo: Scheinecker

Scheinecker manufactures these high-precision solid carbide drills for CFRP-aluminum machining in just four weeks – including the BALDIA COMPOSITE DC coating from Oerlikon Balzers.

Image 2

Photo: Scheinecker

Working together to meet customer demands (from left): Dino Lirk, Technical Director at Scheinecker, and Dirk Schmidt, Product & Key Account Manager at Oerlikon.

Image 3

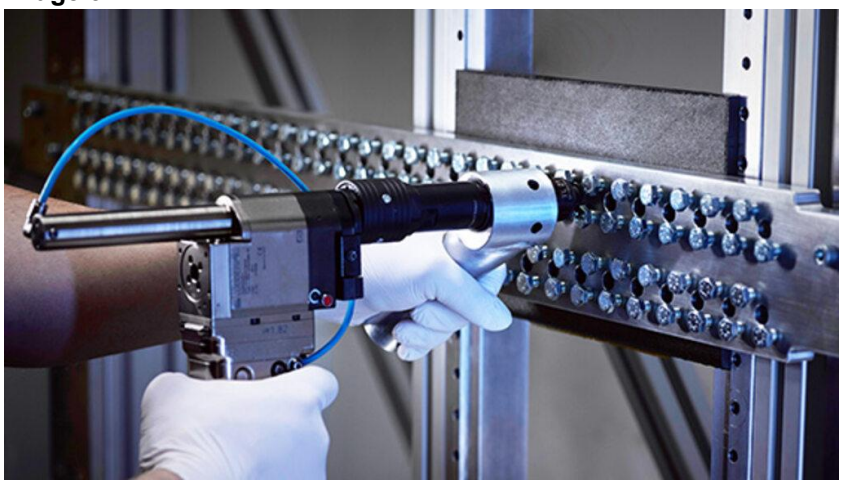

Photo: Scheinecker

In testing with a semi-automated Lübbering drilling unit, the BALDIA-coated solid carbide drill from Scheinecker produced over 1,000 holes in the CFRP-aluminum stack material.

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About Oerlikon Balzers
Oerlikon Balzers is one of the world's leading suppliers of surface technologies that significantly improve the performance and durability of precision components as well as tools for the metal and plastics processing industries.

Extremely thin and exceptionally hard coatings, marketed under the BALINIT and BALIQ brand names, reduce friction and wear. The BALDIA portfolio of diamond coatings enables top performance even when machining very challenging materials. The BALITHERM brand opens up a broad range of heat treatment services, whereas BALTONE comprises coatings that are available in a full range of elegant colours, perfectly suited for decorative applications. BALORA gives components effective protection from oxidation and corrosion in environments with extremely high temperatures. BALIMED ThinFilm coatings, with wear-resistant, biocompatible, antimicrobial and chemically inert properties, have been developed especially for medical applications. Under the BALIFOR technology brand the company has introduced technologies which provide tailor-made solutions for the automotive market.

Worldwide, more than 1,300 coating systems are in operation at Oerlikon Balzers' facilities and its customers. Equipment engineering and assembly of Balzers' systems are processed in Liechtenstein and in Bergisch Gladbach (Germany). Oerlikon Balzers operates a dynamically growing network of more than 110 coating centers in 35 countries in Europe, the Americas and Asia. Oerlikon Balzers is – together with Oerlikon Metco, Oerlikon AM, Oerlikon HRSflow, Oerlikon Riri und Oerlikon Fineparts – part of the Switzerland-based Oerlikon Group.

About Oerlikon
Oerlikon (SIX: OERL) is a global leader in surface technologies and advanced materials. With a unique portfolio spanning surface engineering, high-performance materials, coating equipment and components, we make products better by enhancing performance, efficiency and sustainability. Oerlikon serves a wide range of industries, including aerospace, automotive, defense, energy, medical, luxury and semiconductors.

Headquartered in Pfaeffikon, Switzerland, Oerlikon together with its subsidiary Barmag operates in 38 countries with more than 12,000 employees across 199 locations, achieving sales of CHF 2.4 billion in 2024.