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Technical Article

0.3 microns that make all the difference in tool life

BALINIT® MAYURA increases tool life from 8 to 36 hours and cuts downtime in progressive injection molding

In progressive injection molding, hybrid components made of metal and plastic can be stamped and injection-molded simultaneously in a single tool. But this otherwise highly efficient process can quickly be slowed down by cold welding. Faced with this challenge, the injection molding specialists at FWB Kunststofftechnik found a reliable solution: a microscopically thin protective coating that restored productivity for a major automotive customer — the carbon-based BALINIT® MAYURA coating from Oerlikon Balzers.

Sometimes, the smallest details make the biggest difference. In modern vehicles, pressing the accelerator pedal does not directly move a mechanical linkage, but instead sends an electronic signal from a compact sensor to the engine control unit, which regulates acceleration. These inductive accelerator pedal sensors contain rotors made of metallic conductor loops embedded in plastic carriers. FWB Kunststofftechnik, based in Pirmasens, Germany, manufactures these coin-sized hybrid components using a highly efficient reel-to-reel process.

This automated progressive injection molding method combines two production steps in a single machine: processing a thin aluminum strip and partially overmolding it to create the finished part. During production, the aluminum strip with pre-stamped rotors passes through a multi-stage tool. First, eight rotors are precisely punched in a single step using movable cores and cutting punches. The stamped parts are then transferred to a second stage and overmolded with plastic.

With 45 years of expertise, FWB Kunststofftechnik is a specialist in designing and manufacturing tools for cost-effective yet highly complex progressive molding processes. “The key objective is dimensional accuracy and precise positioning of the parts within the tool to ensure clean stamping and overmolding,” explains Regis Marseu, Senior Tooling Expert at FWB Kunststofftechnik. For example, burrs from the aluminum stamping process must not be carried over into the plastic component.

Cold welding and its consequences: scrap, downtime, delivery delays

Aluminum, however, presented a different challenge. Fast cycle times and the high stamping pressure required for this adhesive material increased thermomechanical stress on the tooling. The result was cold welding on tool components: cores began to jam, and continuous production became increasingly difficult.

“Every eight hours, we had to stop production to clean the cores and dies — a process that took 30 to 60 minutes. Once a week, we completely disassembled and cleaned the tool,” recalls Marseu. The consequences were high scrap rates, frequent downtime, and delivery delays. A precision solution was urgently needed — not only for FWB but also for its parent company, Forvia Hella, a globally recognized automotive supplier of accelerator pedal sensors.

To resolve the issue, FWB turned to surface specialist Oerlikon Balzers as a technical partner. Michael Bilo, Key Account Manager Plastics, recommended the carbon-based ta-C coating BALINIT® MAYURA. With its exceptional hardness (60–70 GPa) and very low coefficient of friction (dry against steel: 0.1–0.2), this coating effectively prevents material adhesion and minimizes cold welding.

The results were immediate. Treating the cores and adjusting the cutting clearance between cores and inserts eliminated cold welding altogether. Building on this success, FWB also had inserts, dies, and guide sleeves coated with BALINIT® MAYURA. In addition, moving parts on the ejector side of the tool were treated with the DLC coating BALINIT® DYLYN to further enhance performance.

Smooth production for months thanks to BALINIT® MAYURA

Since applying the new coating, production has been running smoothly for several months. Around 360,000 parts have already been manufactured in continuous three-shift operation. Cleaning is now limited to a quick brass-brush treatment every 36 hours — with plans to extend the interval to 48 hours.

“We are considering further extending the cleaning interval,” says Regis Marseu, who appreciates Oerlikon Balzers’ reliable technical expertise in complex tooling applications. Today, FWB Kunststofftechnik ranks among Germany’s leading specialists in stamping and injection molding tool technology. The company produces plastic parts with shot weights ranging from 2 to 650 grams, some of which are even pre-assembled before delivery.

At the Oerlikon Balzers customer center in Bielefeld, another FWB tool set for rotor production is already undergoing treatment. The BALINIT® MAYURA coating applied here is only 0.3 microns thick — yet it ensures smooth, uninterrupted production. This example proves that, in advanced manufacturing, sometimes the smallest details can make the biggest difference.

Image 1

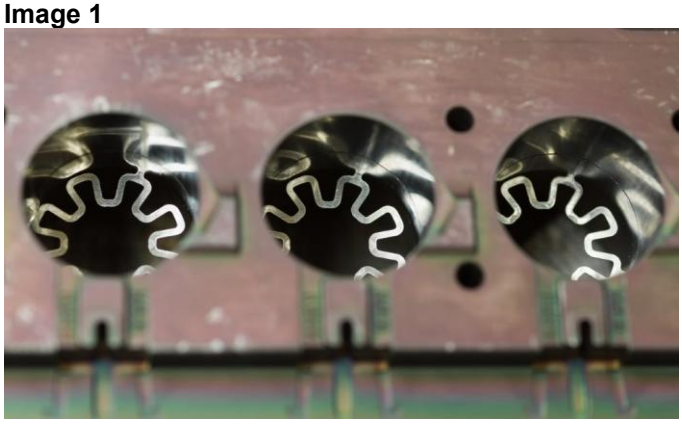

Photo: Oerlikon Balzers

The coin-sized rotors for accelerator pedal sensors are stamped from aluminum and then overmolded with plastic using progressive injection molding at FWB Kunststofftechnik.

Image 2

Photo: Oerlikon Balzers

No more cold welding: Coating tool components with the rainbow-colored carbon BALINIT® MAYURA coating from Oerlikon Balzers ensures smooth and reliable production at FWB Kunststofftechnik.

Image 3

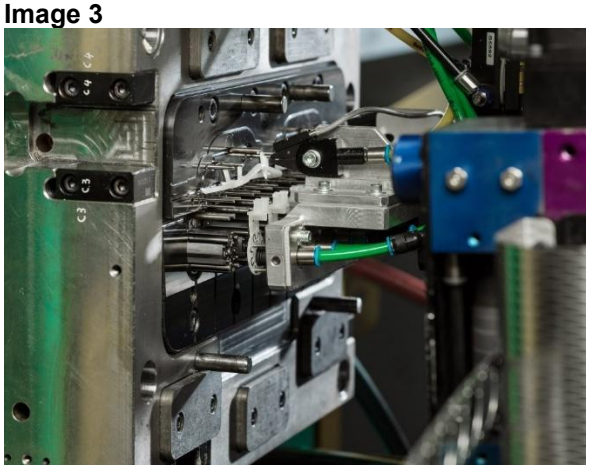

Photo: Oerlikon Balzers

Eight finished rotor carriers leave the multi-cavity tool per cycle. Moving parts on the ejector side are coated with the black BALINIT® DYLYN carbon coating from Oerlikon Balzers for optimal wear resistance.

Image 4

Photo: Oerlikon Balzers

Regis Marseu (right), Senior Tooling Expert at FWB Kunststofftechnik, values the precise technical recommendation provided by Michael Bilo, Key Account Manager Plastics at Oerlikon Balzers.

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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.