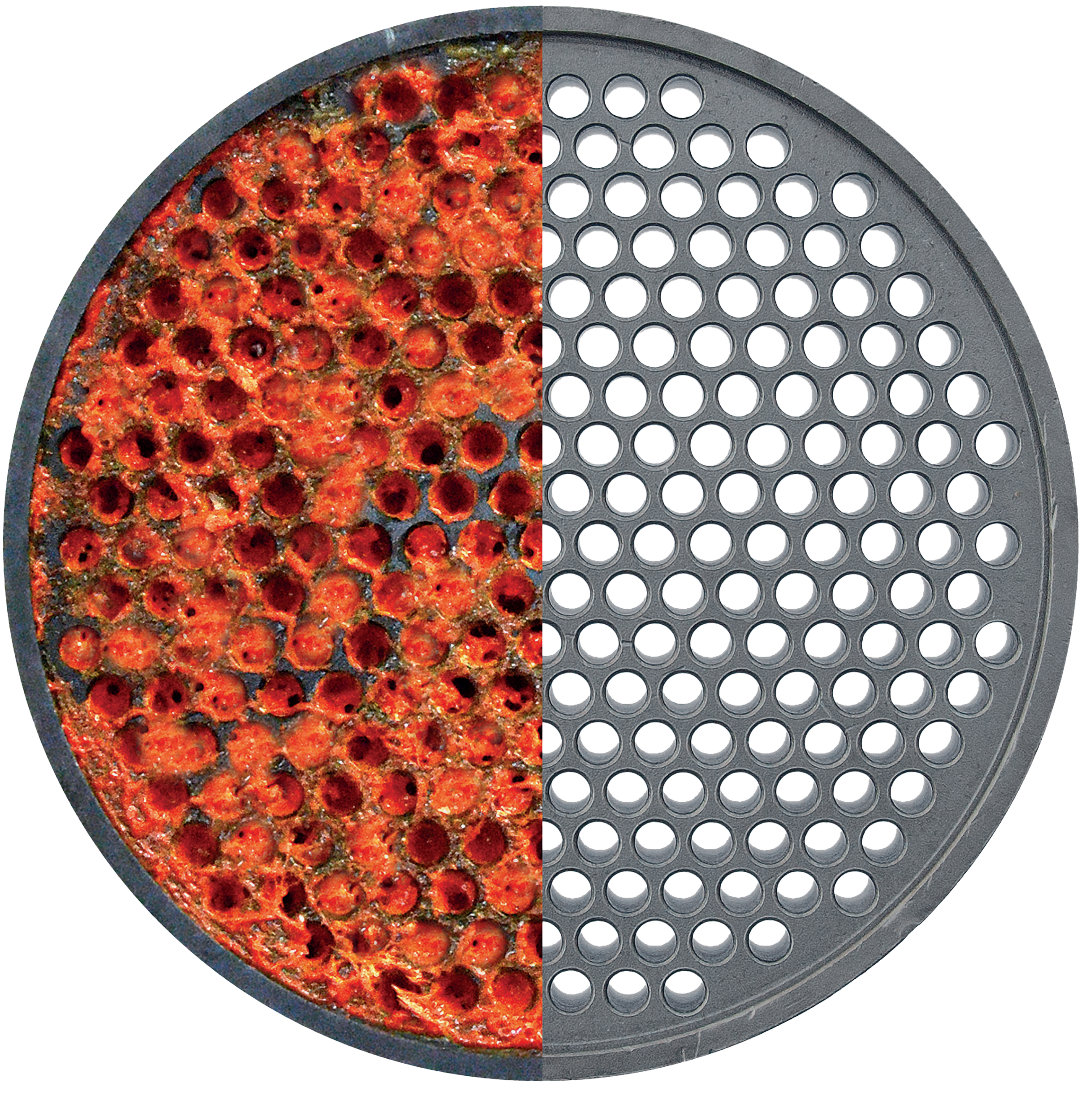


Breaker plate from an extrusion line before and after pyrolysis treatment. © Schwing Technologies

Vacuum Pyrolysis

A Clean Sweep

No matter whether injection molding or extrusion is involved: residue plastic stuck to screws, molds, or filters will impair system efficiency during production. Recyclates tend to build up more quickly than virgin material on machine elements. Schwing Technologies achieves good results with thermal cleaning by vacuum pyrolysis.

Why is it hard to remove plastics? "It sticks like chewing gum." That is how Sales Manager Virgilio Perez Guembe at Schwing Technologies GmbH describes the challenge to removing hardened plastic residues from sometimes sensitive surfaces. In conversation with the editors of ***Kunststoffe***, he explains why cleaning is so important – and what procedures are involved. As a specialist for the cleaning of plastics production systems, he supports his international customers with specific solutions for cleaning polymer-contaminated molds and machine elements.

Recyclates Often Exhibit Low Viscosity When Processed

"When recycled materials are processed, there is an inevitable increase in the cleaning requirements of filters, nozzles, and blow heads. Recycling alters the properties of the material, that is, its viscosity generally falls, making such plastic more likely to stick to the system that a virgin polymer material would." says Guembe. The problem here are highly adhesive carbon residues that "stick right in the pores". During the production process, new material that sticks to them forms additional carbon. Machine contamination by itself is a

Virgilio Perez Guembe, Sales Manager at Schwing Technologies GmbH.

© Schwing Technologies

rather gradual process. The systems keep on running, but their capacity is often regulated downwards when polymer residues stick to the machine components. Only clean systems ensure long-term productivity and energy efficiency.

Plastics Removal: A Comparison of Procedures

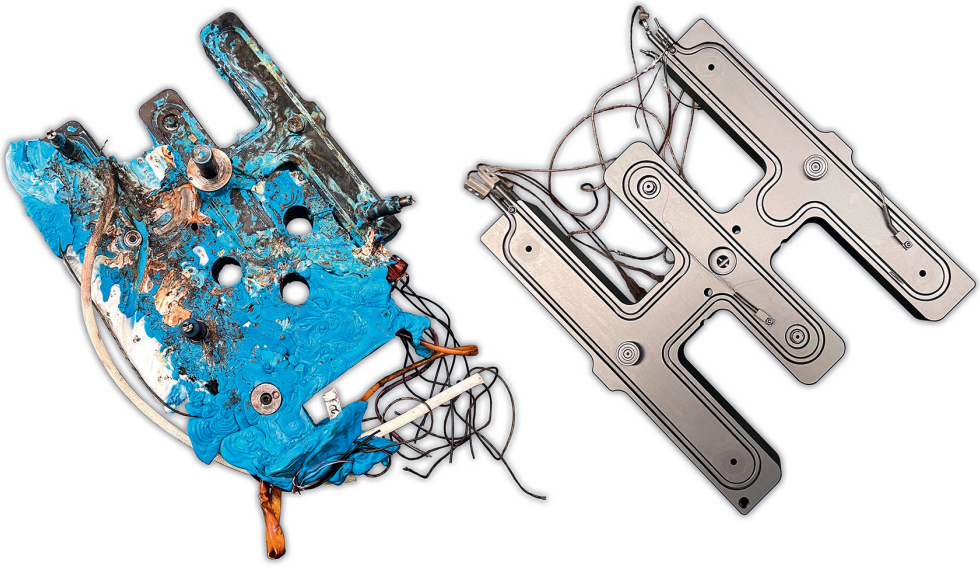
Generally speaking, various procedures are available for removing plastics from machine components. Schwing Technologies has reached the following assessment based on their own experience and research work in their technology center, as well as on evaluations by the Fraunhofer IPK of the cleaning of injection molds:

- **Manual cleaning:** can be done in operation using scratchers, brushes, or burners, but it often results in damage to the molds or system components. The components to be cleaned may warp due to the uneven effect of heat, and damaged mold surfaces can impair product quality. Suitable, at best, for very robust system components and smooth surfaces only.
- **Mechanical cleaning:** performed using dry ice, water, or abrasives, it is environmentally friendly and gentle on materials. Dry ice, however, means high operating expense and is thus not always economical. Other abrasive versions of mechanical cleaning often leave residue from the abrasive behind, as well as surface damage to molds and components.
- **Chemical cleaning:** performed using detergents or chemicals and can be used against certain contaminants in reworking. Depending on the detergent, their use, however, is regarded as environmentally harmful, sometimes takes a long time, and involves high operating costs.
- **Thermal cleaning:** an ecologically friendly, fast, and economical version of plastics removal. If thermal cleaning is done under vacuum or by circulating fluidized bed combustion, it is an especially gentle way to clean components. When certain sensitive and complex tools such as spinning nozzles are involved, follow-up treatment may be required, for example, using ultrasound.

How Vacuum Pyrolysis Works

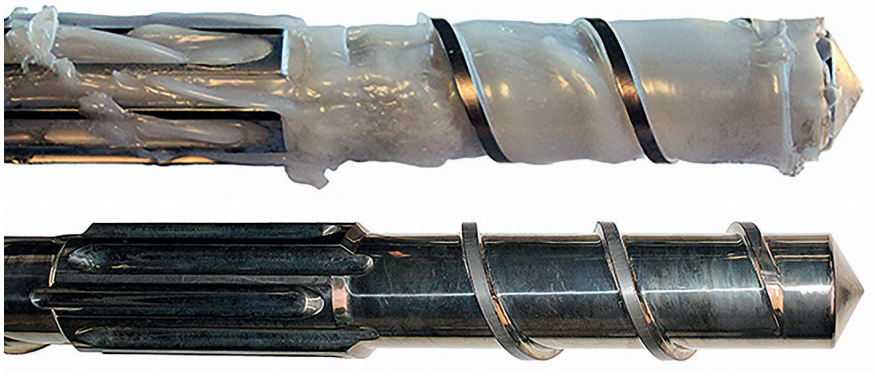
The removal of plastics residues on molds, tools, and long components is performed by the Vacuclean System in an electrically heated vacuum cleaning chamber. Temperature measurements are taken directly on the component to be cleaned which is warmed up slowly and especially gently to materials, whereby a large portion of the stuck plastic melts and runs off. At approximately 450 °C, any remaining plastics decompose. Any remaining carbon is removed at the end by oxidation. Electric current and water are all that the Vacuclean System needs to run. »

Pyrolysis ovens are available in various versions and dimensions. This Vacuum Compact System is suitable for small format parts up to 50 kg. © Schwing Technologies



A hot-runner system before and after treatment. Gentle cleaning is especially necessary for coated systems. © Schwing Technologies

Schwing describes their procedure as economical – literally so, despite the high temperatures required. "Of course, energy prices are a hot issue these days. But compared to other procedures, or a system that doesn't function productively, we are certain that pyrolysis will pay off for its user."



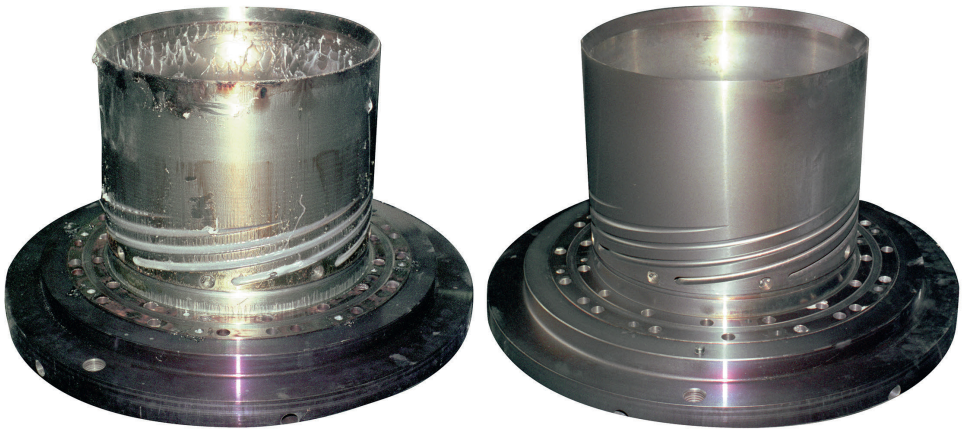
Srew of an injection molding machine before and after vacuum pyrolysis.

Workpieces Weighing Five Tons Lie up to 40 Hours in the Vacuum Oven

How long workpieces are treated in the oven depends on their size and varies from several hours up to 40 hours for workpieces weighing five tons, for example. Pyrolysis enjoys the great advantage of being a gentle procedure. As Guembe states, "Many other procedures attack the surface of the workpiece. Many screws or injection molds are coated, since that is only way to achieved the desired flow rate of the fluid plastic during production. Thus, it is imperative not to damage the coating." Following treatment in the pyrolysis oven, the clean components are removed. Only very fine sieves – mesh sizes of 20 µm are not uncommon in extrusion – are post-processed using ultrasound.

Vacuclean System's range of application is wide, reaching from sieves weighing 10 g to heavy extrusion dies of up to 12 t. Even hot runner systems for 2.5 m long car bumpers are no problem. Schwing advises their customers not only as involves their version of the system, but also helps obtain official approval. "Thanks to our policy competence, we know which regulations have to be complied with. Ultimately, it is the system user's obligation to uphold the limits, for example, for exhaust gas values." Guembe observes.

In the Lab + Tech Center at their headquarters in Neukirchen-Vluyn, Germany, Schwing makes their entire laboratory and process pilot plant available to their customers' development engineers and process technicians. There they can perform specific tests and test series on their own workpiece components and/or materials. Customers are invited to bring their own parts and molds contaminated with plastics along with them. The optimum cleaning procedure is established with assistance from Schwing's process technicians.



Blown film die before and after treatment.

Cleaning Also Available as a Service Including Pick-up and Delivery

Should a proprietary cleaning system not be worthwhile for economic reasons, Schwing offers needs-optimized cleaning services including associated logistical services at several worldwide locations. Each year, more than 250,000 different workpieces are cleaned according to high quality and ecological standards and reintegrated into the customer's production processes. Their customers come from the fields of injection molding, extrusion, industrial coating, masterbatch production, and the fiber industry. ■

Susanne Schröder, editor

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www.schwing-technologies.com

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