Filtration. High quality metal filters should keep contaminants at bay when liquid synthetic resin components are being filled. A cleaning method had to be found for extending the service lives of the filters.

The Cleansing Power of Heat

REINHARD BAUER

DIC Performance Resins GmbH in Vienna, Austria, part of DIC Corporation, Japan, is a leading manufacturer of synthetic resin components for paints, adhesives and industrial coatings. For transport of the end products to the manufacturers, the liquid synthetic resin components are filled into drums, tank cars or containers. As even tiny impurities can lead to downtimes during further processing, filtration is a critical aspect of quality assurance, especially filtration at the filling point. There, pipe filters, referred to as "police filters" on account of their importance, are used for outgoing goods control. At the moment, various designs of metal filter cartridges are in use, with through-holes ranging from 5 to 500 µm to match the viscosity of the produced resins. But they are only a recent solution.

Fig. 1. A series of five pyrolysis chambers is available, ranging from a laboratory model having a chamber volume measuring 280 mm in diameter and 580 mm in length through to industrial scale systems measuring 900 mm in diameter and 1,600 mm in length (photo: Econ)

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Alternative Cleaning Method Permits System Changes

Before the switch-over to metal filters took place, filtering was primarily done with needle-felt filter bags. However, these filters had a significant downside: since it is impossible or uneconomical to clean them, they had to be replaced after each production batch – which was not in itself an issue as textile filters are inexpensive. The real problem lay in handling and disposing of the used filters. In the search for a solution, several alternative types of filters and systems were evaluated and rated. Metal filter cartridges were among the candidates, but they are relatively expensive to buy. So a non-destructive cleaning method was sought that would maximize their service and functional lives.

Immersion in or washing with solvent failed to fully resolve the problem, especially for filters with small holes. Nor did flaming and burning off of the residues yield reproducible results. Local overheating led at best to warpage of the cartridges and at worst to destruction of the screen structure.

Dr. Sven Hafkesbrink, Plant Manager at DIC Performance Resins GmbH, casts his mind back to the situation: "From preliminary trials, we knew that metal filters were the more reliable filters. That went part of the way toward justifying their higher capital costs. It was hoped that the environmental aspect – using them for at least 20 to 30 cleaning cycles – would do the rest. As luck would have it, we came across a laboratory furnace with attached flue-gas treatment system."

! Company Profile

Founded in 1999, **Econ GmbH,** Weißkirchen/Traun, Austria, specializes in extrusion auxiliary services. It mainly makes components for pelletizing systems, for the production of virgin material and for recycling installations. Chief among its products and services are underwater pelletizing systems, pellet-drying stations along with the equipment for water treatment, as well as screen changers for melt filtration. The portfolio is rounded out by a range of pyrolysis furnaces for gentle thermal cleaning of system components. The company's innovativeness is underscored by 20 patents. In 2008, its 27 employees generated sales of around EUR 5.2 million.
www.econ.eu

Successful pyrolysis trials and an internet search ultimately led to Econ GmbH, a manufacturer of pyrolysis installations for industrial use.

Synergy with Pelletizing Technology

Econ's core business is the production of auxiliary equipment for extrusion lines, including pelletizers and screen-changing systems for melt filtration. Pyrolysis furnaces for removing polymer residues

Fig. 2. For DIC Performance Resins, pyrolytic cleaning is the most economical way of eliminating contaminants and resin residue from all kinds of installation components because it is non-destructive: shown here are pipe filters: contaminated filter (foreground), after pyrolysis (background) (photo: DIC Performance Resins)

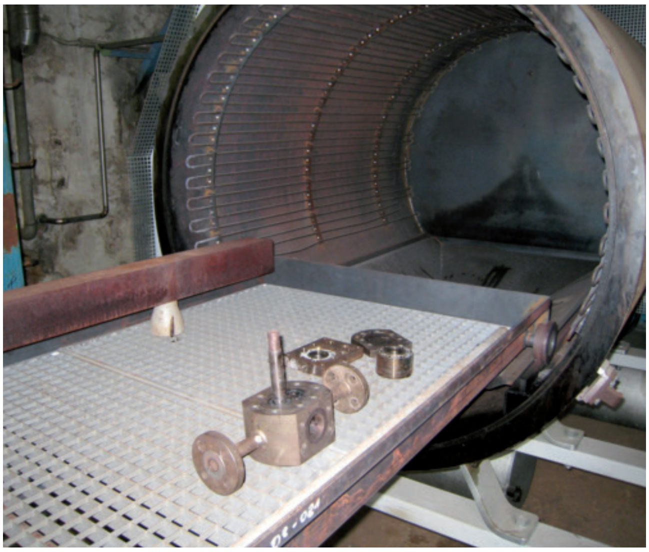

Fig. 3. The inside of a pyrolysis furnace (photo: DIC Performance Resins)

Fig. 4 . Günther Weninger (left), a production foreman at DIC Performance Resins, and Alexander Datzinger, a regional sales manager at Econ, shown with several components that can now be cleaned much more efficiently by pyrolysis (photo: DIC Performance Resins)

from screen plates round out its product range (Fig. 1).

The company has adopted a "stand-alone" approach for pyrolysis furnaces, which allows them to be used universally. The furnaces are not only equipped with powerful heaters, but also boast an integrated vacuum generator and an activated carbon system for adsorbing pyrolysis gases. The vacuum generator features dry-running, oil-lubricated vacuum pumps without water lines. Thus, there is no contamination of cooling water by pyrolysis gases or any need for water treatment.

The actual cleaning process comprises a customizable heating cycle in a vacuum environment. The chamber is filled and the furnace is heated up incrementally. When the polymer's melting temperature has been reached, any adhering resin residues flow down into a catch pan beneath the installation. After a specified period of time, the temperature is raised to a higher level. Pyrolysis of the residues then occurs (thermal cleavage in the absence of oxygen). The resultant dusty ash particles are separated from the workpieces by means of compressed air at the end of the heating cycle and cooling.

In the case of DIC Performance Resins, the cleaning process consists of a 12-hour cycle, during which time the molded parts are heated to 200 °C, which is maintained for about 2 h to allow the residues to melt and run off, and is then raised to the pyrolysis temperature of 400 °C for 4 h. This is followed by a cooling period of 3–4 h. The pyrolysis gases in this case are not passed over an integrated adsorber, but rather are fed to the existing gas incinerator. It is the practice at DIC to run a cleaning cycle automatically during a night shift (Fig. 2).

Says Dr. Hafkesbrink, "Our experience suggests that pyrolytic cleaning in a chemical plant – which is what we operate – will simplify a large proportion of ongoing maintenance, rendering it more environmentally friendly and thus more cost effective. The method could potentially be used for a whole range of cleaning tasks – not only for filters, but also for all the housing groups and other components which are hard to access. We were banking on this outcome at the very start when we opted for the largest Econ Pyrolysis Furnace model with a chamber diameter of 900 mm and a length of 1,600 mm (Fig. 3). This has paid off – the investment is set to be recouped in the near future. The test results speak for themselves." (Fig. 4.) ■

! Company Profile

The origins of **DIC Performance Resins GmbH** date back to 1898 and the founding of Reichhold Chemie by Carl Reichhold, who developed resins for extremely fast-drying paints. These were primarily of interest to the emerging automotive industry. But synthetic resins played an important role in other industrial branches, too, especially in adhesives, as auxiliaries for industrial production processes and as components of consumer goods. In 1987, Reichhold Chemicals Inc was acquired by DIC Corporation. In 1998, the Kagran site in Vienna, Austria, was reconfigured for resin production. This was followed in 2003/2004 by production startup of high-quality coating powders for the automotive sector. The site reorganized in 2005 and the company name changed to DIC Performance Resins GmbH. Overall, DIC Corporation employees 25,000 staff, has 213 subsidiaries in 59 countries and generates sales of EUR 7.09 billion (2008).
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