

Optics in One Shot

Pentacon Can Now Overmold Coated Glass with Plastic – and Not Just for the Optics Industry

The particular properties of coated glass previously made it virtually impossible to overmold completely. The material was too inflexible and brittle and frequently led to quite high reject rates, so that mass production rarely seemed sensible. Pentacon GmbH has now developed a process that solves these problems and so opens up a new product field.



Until recently, processing coated glass presented the plastics industry with huge challenges because such special glass was seldom able to withstand the pressure and heat stresses of molding-on the mountings in large-scale production. Pentacon GmbH has now found a solution to this, for which a patent application has been filed.

This Dresden-based company has a long tradition in the area of precision en-

gineering and optics and enjoyed world renown as the manufacturer of single-lens reflex cameras until German reunification in 1990 (see **Company Profile**, p.48). Today, as the subsidiary of Jos. Schneider Optische Werke GmbH from Bad Kreuznach, Germany, the company manufactures high-precision injection molded parts and supplier components for the automotive industry (among other products). In particular, the area of hybrid com-

ponents – i.e. inserts overmolded with plastic – has become increasingly important for Pentacon in recent years and has developed into a core competence in the field of plastics technology.

Optical Filters for Photographic and Industrial Applications

Among the main products manufactured by the parent company Jos. Schneider »

The Authors

Dipl.-Ing. Manfred Meissner is one of the developers of the novel process described here and is responsible for supervising the project; manfred.meissner@pentacon.de

Dipl.-Ing. (FH) Dierk Püschel is Head of the Plastics Engineering Department at Pentacon GmbH, Dresden, Germany; dierk.pueschel@pentacon.de

Company Profile

Pentacon GmbH can look back on a long history to the early years of the 20th century. Foundation under the actual name Pentacon took place in 1964 with the merger of various companies in and around Dresden, Germany. In 1990, parts of the company were acquired by the Jos. Schneider Group based in Bad Kreuznach, Germany, and have since become a subsidiary of one of the most innovative companies in the optics sector. Some 125 employees currently work at the Dresden site. Besides injection molding precision plastics products, Pentacon is also a specialist in CNC turning of thin-walled metal parts and profile rolling of long-turned parts, as well as a certified automotive supplier for large-scale production. In addition, the company develops and produces industrial image processing systems for quality control.

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are optical glass filters for photographic and industrial applications. The conventional brass mounting system for optical filters frequently consists of two or more turned rings that securely hold the inserted filter glass by a mechanical device. These glass filters are usually previously vacuum coated with various coatings, e.g. to prevent unwanted reflections or make the surface less sensitive to contaminants. Optical glass filters are also very often brittle and react sensitively to thermal deformation or high pressure.

Manufacture of the filter mountings also requires high precision, since the screw thread is often turned on very, thin-walled material. Subsequent assembly of the glass filters and rotary mounts is a costly, time-consuming, mechanical operation, often carried out manually.

The Pentacon process adopts the hybrid approach, replacing the brass filter mounts with high-strength plastics. Initially, several hurdles had to be overcome to manufacture an equivalent product. As already mentioned, the first problem was the brittleness of the glass filters. The glass blank is briefly exposed to a pressure of up to 1500 bar and heated up to 320 °C during the injection molding operation. Through the special process design, damage such as cracked or even completely shattered glass, is practically avoided – even with density variations in the glass filters. The reject rate in the Pentacon production process is now on a par with that of conventional plastic parts.

A further challenge was exact replication of the fine threads that in the case of the brass variants were turned using CNC. In the in-house mold-making shop, the company therefore focused on high precision and optimized the process over a fairly lengthy period of mold proving to ensure exact replication of the fine thread and other details of the finished component such as recessed grips and surface structures.

Unlike metal threads in the thread-turning process, molded-in plastic threads undergo deformation during the cooling phase, since every plastic has its own characteristic deformation behavior. With the aid of comprehensive Moldflow analyzes, even before prototype production, this aspect of the process was also continuously optimized, for example by adjusting the cooling times or mold wall temperatures.

Advantages of the Process

For large-scale production, the injection molding machines were fitted with special handling systems that ensure precise placement of the glass optical filters and careful removal of the overmolded parts. This opened the way for mass production of different filter types and sizes.

One of the advantages of plastic-overmolded filters is that several manufacturing steps (turning the mounts, assembly, etc.) can be combined in a single process. In addition, the material substitution cuts costs, since the plastics used, e.g. a PA6-GK30, are much cheaper



Watch glasses frequently have special hardness and coatings. The new process now permits flush overmolding of these glasses and therefore a simpler method of assembly

(© Pentacon)



The mountings for dial indicator glasses (for a water meter in this example) have previously been made of brass and the sight glass mechanically screwed-on. Now, the brass can be replaced with plastic and the glass completely overmolded (© Pentacon)

sector and manufacturers of sight glasses and dial indicators. For example, special glass elements that have been pre-sealed and pre-screwed are sometimes required for use in harsh industrial environments. With the Pentacon process, such applications can now be implemented much more quickly and at lower cost. In collaboration with customers, the overmolded glass elements are currently being tested and certified under laboratory conditions for their leak tightness and behavior under pressure stress.

Flush overmolding of glass elements is of interest to other industry sectors, too. Many new potential applications are opening up in areas ranging from the consumer goods and electronics industries to solutions for the watchmaking industry and often these come much closer to meeting the aim of reducing assembly costs.

Conclusion

This process expands the range of applications for coated glass elements many times over and permits the use of new materials in different applications that previously had to be installed by mechanical methods at high cost. ■

than brass alloys. Plastics also react less sensitively to temperature changes. Depending on the particular material pairing, metal mounts tend to seize as a result of expansion, especially at higher ambient temperatures, and can then only be undone by force. At low temperatures, on the other hand, the screwed connection to the lens starts to

become loose. Plastic is much more stable under such changing temperature conditions and protects the glass filters as well.

Applications for Other Sectors

Besides the optics industry, other customer groups include the automotive

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Existing Regloplas temperature control units can be extended with the vario



On the left pressurized-water temperature control unit P180S for water temperatures up to 180 °C, on the right the vario switching unit with the optional "energyBattery"

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switching unit by changing to a vario-thermal production process. According to the manufacturer, it is a simple, individually adaptable and inexpensive system for maximum flexibility in the high-temperature range (for applications with

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