A Luminous Greeting

Lumitec Masters Injection-Compression Molding thanks to Arburg Application Technology

The Swiss company Lumitec specializes in luminous technology. When they could not find an injection molder capable of achieving the high-quality in-mold film lamination required for series production, they got into injection-compression molding more or less "overnight". Machine builder Arburg supported that goal not only with a specially configured machine, but also and more importantly, with their know-how as application engineers.

The panels are installed in sports car seats and glow as a welcome when the car door is opened. The assembly elements are subsequently ultrasonically welded to the component © Arburg

The application of electroluminescent films is one of the core competencies of Lumitec AG in Gais, Switzerland. Less than 1 mm thick, these films emit light when an electric field is applied to them. They are characterized by their multi-layer structure: a so-called dielectric lies between two electrodes. One of the electrodes consists mainly of a translucent plastic film printed with an indium tin oxide structure; the other one reflects the light. Thus, the structure of an electro-luminescent film (EL film) is similar to that of a plate capacitor. "Electro-luminescent lighting systems are essentially luminous capacitors. Applying an alternating current to both electrodes excites the luminous crystals in the dielectric to glow," as Lumitec CEO Emil Enz explains. By utilizing latest production technologies, the company aims to improve the EL-film's long-term behavior, optimize light distribution, and minimize power consumption.

Lumitec uses these films to create smart applications, such as back-lit covers for sports seats in automobiles (**Title figure**). They are installed in the seatbacks as identity carriers and "welcome indicators" and are backlit in color when the car is opened with the remote control key or the door handle. The optical requirements on the product are consequently very high.

Sophisticated Look

The black surface requires a high-quality high-gloss finish and very high resistance to extreme temperatures and at times highly aggressive leather lotions. Enz explains the considerable technical challenges: "The challenges relating to the visual characteristics could only be solved because, instead of the HPF process (High Pressure Forming), thermal preforming was chosen. This means that the film is not fully formed, but that the final shape is achieved only during the injection molding process. This requires the compression molding process."

During injection-compression molding, the mass of plastics melt is injected into the slightly open (the so-called embossing nip) mold which is not completely closed until solidification has begun. Uniformly increasing clamping pressure subsequently produces the final shape of the part. The holding pressure phase is thus replaced by a compression

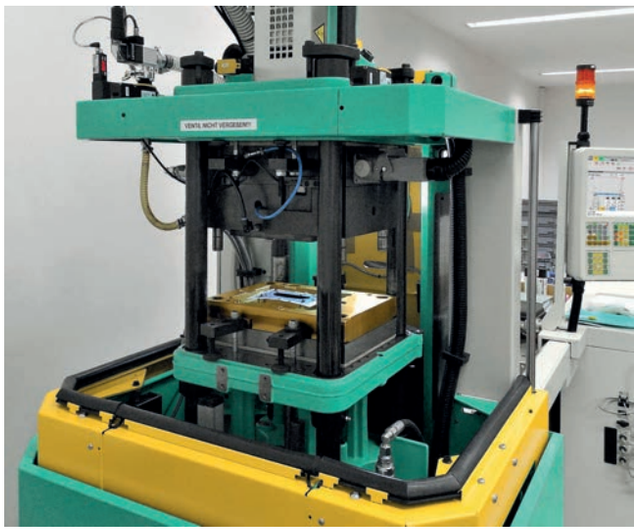

Fig. 1. In this application, the Allrounder 270 S injection molding machine has an upright clamping and injection unit © Arburg

phase. This renders injection-compression molding a low-pressure process for protecting such inserts as films or decors. For lighting applications in particular, low pressures can minimize internal stress on the part. For this process, an injection molding machine must have high repeatability.

The Machine with an Upright Clamping and Injection Unit

Problems arose during pre-series production of the sports seat panels, since no injection molder could produce high-quality parts for Lumitec in series. Ultimately, an optimization inquiry via IfK Ingenieurbüro für Kunststofftechnik in Balingen, Germany, – the automation firm that Lumitec works with – found its way to Arburg's application engineers who quickly recognized that success depended on changing the mold already in use. After just one day of intensive testing, a production data record was created and a recommendation made for further optimizing the mold.

During the analysis, Lumitec learned how a process can be optimized by using process and monitoring graphics, and how the graphics should be interpreted. Right the next day, the Swiss considered purchasing a suitable injection molding machine, which quite surprised Arburg. Soon after that, an Allrounder 270 S hydraulic machine with a swiveling clamping unit was integrated into a production line at Lumitec (**Fig. 1**). On this machine with an upright clamping and injection unit, the films preformed in thermoforming steps are inserted manually and then laminated in-mold with PC+ABS by compression molding (**Fig. 2**).

Fig. 2. Pre-formed electroluminescent films are laminated in-mold to produce backlit sports seat panels © Arburg

All process steps require tightly controlled sequences, especially when the film is pre-formed in the mold, and during injection molding. The key to success here is the programming of the compression phase, since the shaping of the film is influenced by three temporally overlapping process steps: injection molding, ancillary axis compression, and main axis compression.

Out of Nothing and into the Niche

Emil Enz' conclusion is positive: "The main factor that enabled us to manage the whole process within around six months – from the specifications for mold construction to the purchase of the injection molding machine and the implementation in production-ready processes – is the outstanding support from Arburg application engineering and the German engineering consultants IfK . We thus successfully ventured from nowhere into one of the most demanding niches in injection molding technology." Since purchasing the machine, Lumitec has moved on to the second generation of panels; the Swiss were able to independently adapt the process to the new films. ■

Company Profile

Lumitec AG of Gais, Switzerland, specializes in the development and production of electroluminescent films and systems. The company founded by Emil Enz in 1986 has about 15 employees and serves customers mainly in the automotive, aerospace, and watch industries.

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