ALFATER XL®

Extrusion Grades

ALBIS

PROCESSING GUIDE

ALFATER$^{XL®}$ is a thermoplastic vulcanizate (TPV) based on PP and cross-linked EPDM. ALFATER$^{XL®}$ E 2GP0000 series is optimized for extrusion processes such as profile and extrusion blow moulding. Typical extrusion applications are shown in Figure 1.

Processing of TPV is generally different from conventional thermoplastics. The following extrusion guidelines aim to provide a first support, especially for customers with less experience in TPV processing.

Figure 1: Air duct produced by extrusion blow moulding

Figure 1: Sealing profiles produced by profile extrusion

DRYING

The ALFATER$^{XL®}$ E 2GP0000 series is basically non-hygroscopic. However, drying for 2 – 4 hours at 70 – 80 °C in a dry-air dryer is recommended to remove any surface moisture. Open bags should not be stored over a long period of time.

FLOWABILITY

Harder ALFATER$^{XL®}$ E 2GP0000 grades have basically higher viscosity than softer grades. The viscosity of ALFATER$^{XL®}$ is more sensitive to shear than to heat (Figure 2). Appropriate flow and homogeneity of the ALFATER$^{XL®}$ melt is achieved by applying sufficiently high shear during extrusion. In contrast, temperature increases have only a moderate effect on the flowability of the ALFATER$^{XL®}$ melt.

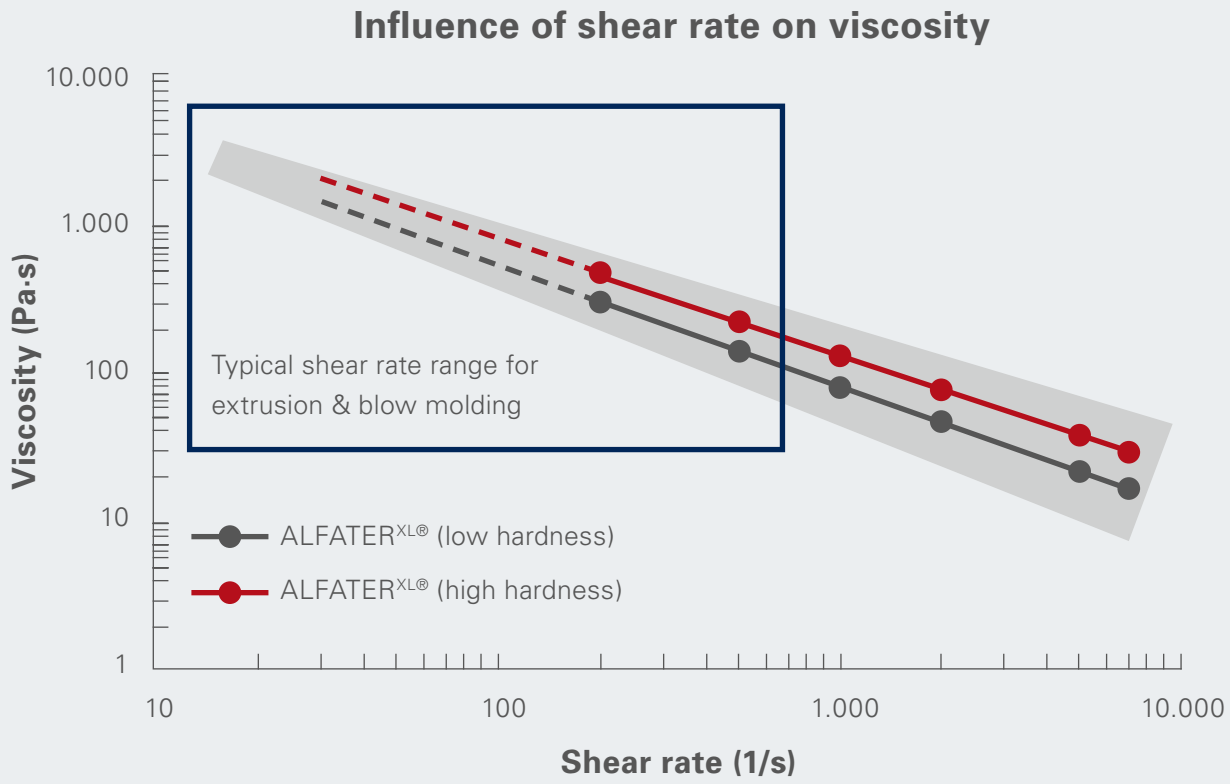
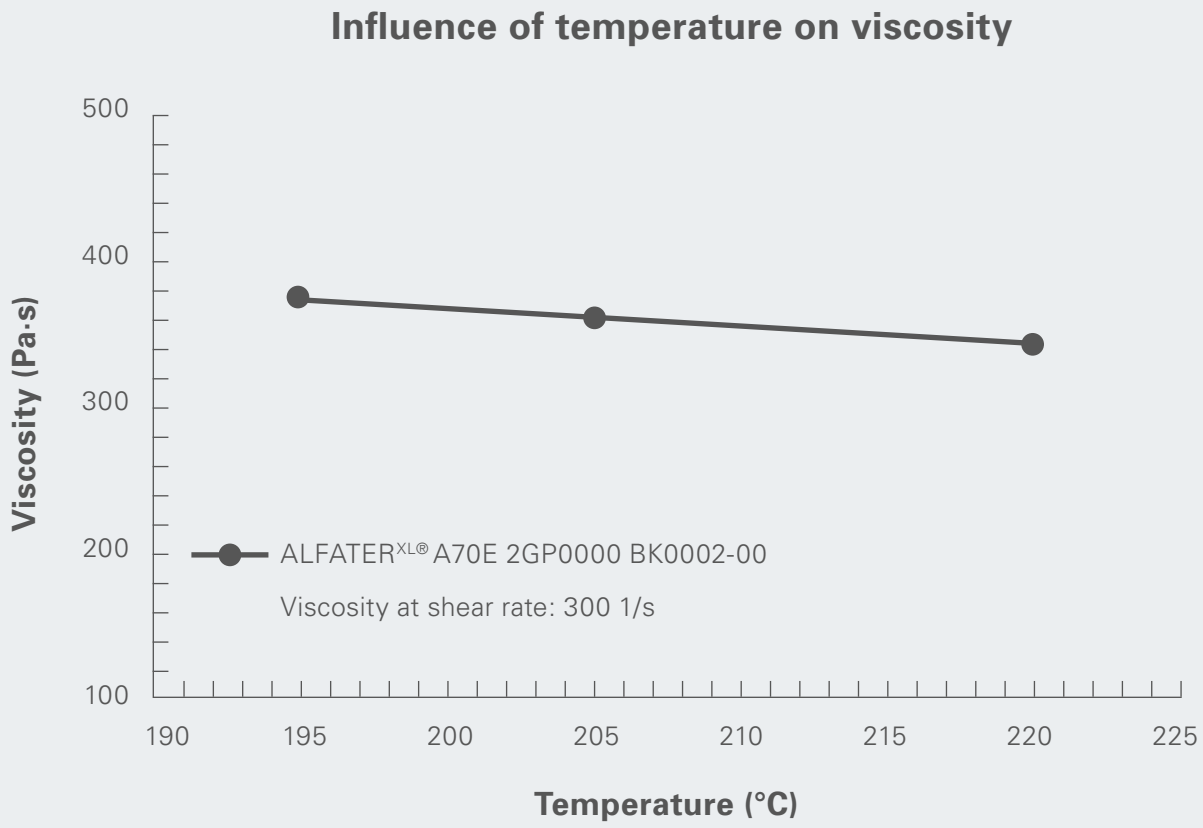


Figure 2: Influence of shearing and temperature on the flow behavior (viscosity) of ALFATER XL® melt.



MACHINERY AND EQUIPMENT

Polyolefin extruders with three zone screws are recommended for extrusion of ALFATER$^{XL®}$ E 2GP0000. A screw length L of 20D to 30D is preferred. Very short screws (L < 20D) are not recommended. Below is an example screw design for ALFATER$^{XL®}$ E 2GP0000 (Figure 3). This design is only a guideline.

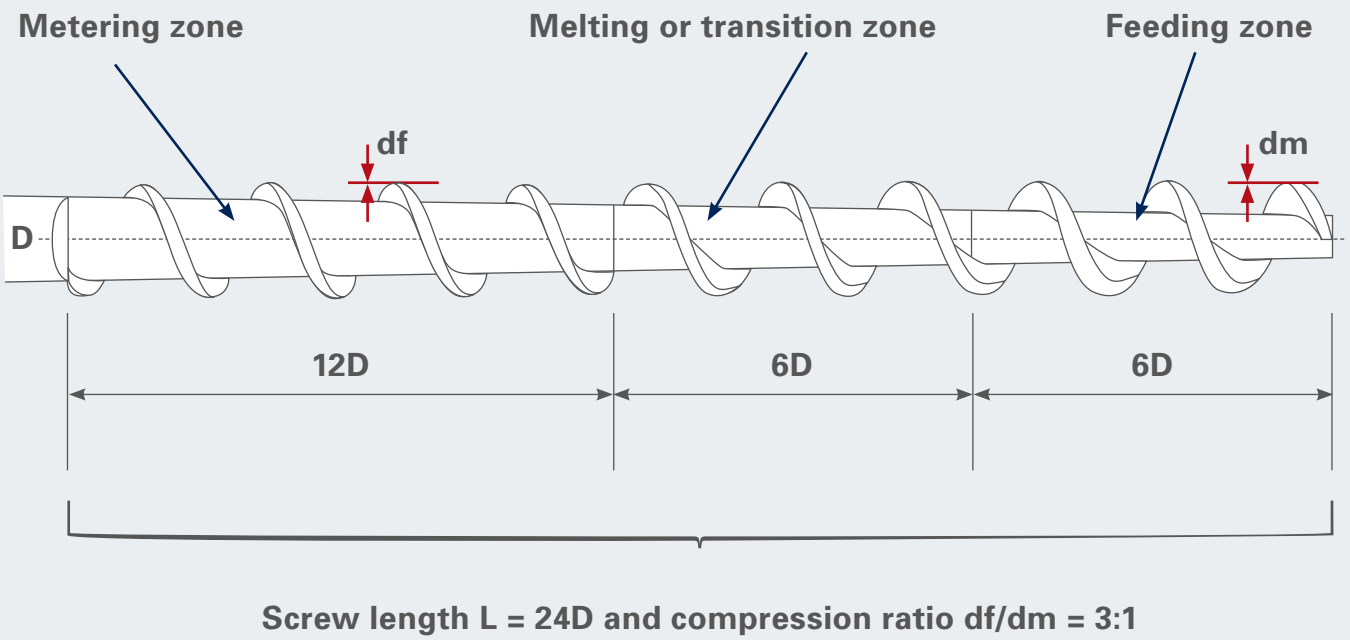


Figure 3: Example for a screw design for extrusion of ALFATER$^{XL®}$.

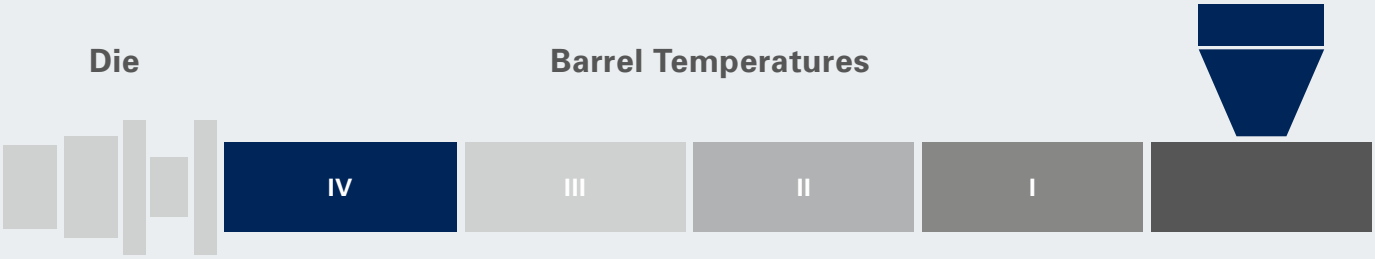
The feeding section should be approximately 25 % of the screw length with rather deeper flights to achieve efficient transportation and compaction of the material. The melting or transition zone should also be approximately 25 % of the screw length. The metering zone should be roughly 50 % of the screw to provide sufficient shear, homogenization, and mixing capacity. Special mixing or shear elements such as barrier screw elements, Maddock screw elements or Egan screw elements may be used additionally to optimize mixing and homogenization of the ALFATER$^{XL®}$ E 2GP0000 melt. In addition, a breaker plate with a mesh screen pack at the screw tip can further improve the melt homogeneity. The compression ratio df/dm should be 2.5:1 to 3.5:1 (maximum 4:1). Large extruders with low screw speed are preferred instead of short extruders with high screw speed.

SCREW SPEED

The screw speed should be in the mid-range from approximately 25 – 80 min^{-1}. An elevated extrusion speed has in most cases a positive effect on the extrudate quality. Too low screw speed can lead to insufficient melting, mixing, and homogenization of the ALFATER$^{XL®}$. Very high screw speed results in good mixing but can cause quality issues such as excessive shear heating or mechanical degradation of the ALFATER$^{XL®}$ melt. For good melt homogeneity it is preferred to use a long extruder with medium screw speed instead of short extruder with very high screw speed.

TEMPERATURE PROFILE

The temperature profile below is a guideline and a starting point for process optimization (Figure 4). Temperature adjustments can be necessary depending on the profile design, the extrusion process, and the ALFATER$^{XL®}$ grade. Higher temperatures are recommended for the harder grades whereas the softer grades can be processed at lower temperatures. Proper cooling is necessary when a grooved feeding section is used to avoid bridging during feeding the material.



Temperatures in degrees Celsius (°C)[1]					Hardness (Shore)
190 – 210	190 – 210	180 – 200	180 – 200	170 – 190	50 – 90A
200 – 220	200 – 220	190 – 210	190 – 210	180 – 200	40 – 50D

[1] Guide values. Standard starting profile might be in the middle.

Figure 4: Recommended temperature profile for extrusion of ALFATER$^{XL®}$ (the temperatures are only a guideline).

Optimal mass temperature of the ALFATER$^{XL®}$ melt should range from 200 – 230 °C. Too low mass temperatures can cause extrusion problems such as poor surface quality or inhomogeneity. Too high mass temperatures can also lead to extrusion problems such as low melt stability, dimensional instabilities, material degradation or evaporation of additives. Therefore, it is recommended to avoid mass temperatures of ALFATER$^{XL®}$ higher than 260 °C for long residence times (> 10 min) in the extruder. The maximum residence time for ALFATER$^{XL®}$ depends basically on the extrusion process used and the shear and heat transfer into the material e.g. screw design, screw speed.

USE OF REGRIND

Basically waste which is produced during extrusion can be recycled and used as regrind in new production. The maximum level of regrind which can be added to new production depends on several factors such as the profile design and application. Therefore, it is advisable to define the specific feeding level of regrind for each individual extrusion process and profile. Regardless of this advice, a feeding level of 20 % regrind in new production is the general recommendation. The recycled material can be dry-blended (physically mixed) with prime (virgin) material. The regrind should be clean and free from any impurities. Furthermore, grinding of the scrap to a particle size comparable to the virgin granules is advisable for effective dry-blending. Drying of the recycled material is also recommended. Drying conditions are similar to prime quality, 2 – 4 hours at 70 – 80 °C in a dry-air dryer.

COLORING

Natural ALFATER$^{XL®}$ E 2GP0000 can be easily colored. The best choice would be a colored ALFATER$^{XL®}$ compound as this ensures the highest color consistency and batch-to-batch repeatability – please contact your local ALBIS Sales Office for more information on ALFATER colour compounds.

Alternatively polyolefin-based color masterbatches can be used. In this case, PP or PE color batches offer excellent compatibility with ALFATER$^{XL®}$ E 2GP0000 and are preferred. ALBIS PLASTIC GmbH offers a broad portfolio of PE and PP color batches from AMPACET. The viscosity of the color masterbatch should be in the range of a typical extrusion grade. A melf flow rate (MFR) < 20 g/10min is preferred. Typical feeding level of the batch is 1 – 5 %. However, the optimal dosage can vary depending on the product or application. It is therefore highly recommended to discuss optimal feeding level either with the color masterbatch producer or with the local TSAD (Technical Services & Application Development) of ALBIS PLASTIC GmbH.

Sufficient mixing of the color masterbatch with the ALFATER$^{XL®}$ melt is necessary to achieve high quality colored products. Mixing can be improved using appropriate extrusion process parameters such as screw filling level. In addition, proper mixing elements e.g. mixing head and/or mesh screen packs at the screw tip further improves the dispersion of the color masterbatch.

Should you have any further questions regarding the extrusion processing of ALFATER$^{XL®}$, then please feel free to get in touch with your local TSAD engineer – contact details are available from the ALBIS website.

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