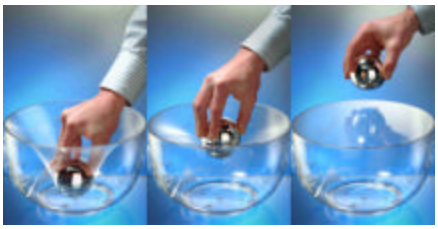
Styroflex® *Processing & Performance*

Description

Styroflex® is BASF's transparent, elastic copolymer based on styrene and butadiene. Styroflex owes its unique property profile to a special molecular architecture. Thanks to its excellent processability and high thermal stability, this product is suitable for film extrusion as well as injection molding. Styroflex is poised to conquer broad fields of applications in films, compounds and as an effective, impact-modifier.

Production Line Selection



Styroflex 2G66 can be processed on standard LDPE and HDPE blown film lines with no equipment modifications. Styroflex may also be processed on cast film and coating lines. Screw design should permit a melt temperature of 350-400°F at full rates. Standard metering screws are acceptable. Barrier screws will often provide superior throughput at reduced melt temperatures.

Dual lip airings are preferred – single lip airings may also be employed. Bubble stability is comparable to LDPE when blow up ratio is below 3:1. The nips should be composed of two rubber rolls and be capable of handling film thicknesses below 0.5 mil. Center or surface winders can be used with Styroflex film, although center winders are preferred because of the cling properties of the film. Throughputs are comparable to LDPE.
No Predrying of Styroflex 2G66 is required.

Film production with Styroflex®

Before starting any trial, the equipment should be purged well with a LDPE grade having a melt index of 1 to 2 g/10 min.

The extruder and die temperatures should be brought to the target levels during purging, giving a melt temperature target of 380°F.

Styroflex should be introduced during film production, and will blend with the LDPE well before purging into the line. Total purge in may require 1 hour, depending on rates and line cleanliness. Typical transition time is 30-40 minutes.

Tension at the film winder should be set to the lowest possible level to prevent blocking.

Chilled cooling air is not typically required for Styroflex film production, as the polymer is amorphous and will cool quickly. However, cool film will help to prevent blocking.

Extruder Settings

Typical barrel zone settings will vary depending on the extruder size, production rate and screw design. Below are the recommended settings for a metering screw for a 2" extruder and blown film die.

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Die & Adapters
330°F	360°F	380°F	380°F	390°F	400°F

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Feed throat cooling is essential to prevent the potential of hopper or throat bridging. For multilayer systems, matching the flow characteristics of the Styroflex to the other components is ideal. This can be often be accomplished with the melt temperature. In general, Styroflex is very compatible with polyethylenes for multilayer film extrusion.

Styroflex Additives	Level for 1 mil film
Styrolux NB batch	3-5%
Styrolux ASE batch	1-2 %
HIPS (medium particle size)	2-3 %

Bubble Cooling

Styroflex does not require as much cooling in a blown or cast film process as polyethylene. Cooling rates can be lowered in general. However, using less airflow to accomplish this can sometimes create bubble control problems, particularly for dual lip airings. Using a slightly higher air temperature in these cases is recommended. Chilled air and IBC configured lines should not present a problem for Styroflex film production. As an amorphous polymer, cooling will not affect clarity or properties.

Processing Characteristics

Styroflex has an order-disorder transition (ODT) temperature of approximately 293°F, at which point the melted polymer adopts a homogeneous structure. It is the homogeneity of the melt that makes Styroflex so suitable for producing coextruded blown and cast film. In contrast, conventional styrene-butadiene block copolymers are prone to crosslinking, and their melt rheology makes them less suitable for thin-film extrusion.

For best extrusion results the extruder should feature a cooled and grooved feed zone. A temperature range of 340 and 400°F is recommended for thin films.

Recovery of Production Waste

Styroflex is compatible in a recycle stream with PE, however the clarity of blends will decrease with Styroflex content. Styroflex will increase the elongation and puncture resistance of LDPE in films. Styroflex may be recycled and extruded into strands or repelletized in multiple passes with no appreciable change in physical properties. Styroflex will act as a compatibilizer in a multi-layer film recycle stream.

Printing and Finishing

Styroflex can generally be printed on conventional printing machinery. Films should be corona-treated prior to printing to a Dyne level above 40. A wax additive in the Styroflex formulation can bloom to the film surface after treatment, thus lowering the surface energy below 30 dynes and making ink adhesion poor. Boost treating or retreating the film prior to printing after several weeks of film storage is recommended.

Finishing processes require the use of films with adequate slip and antiblock performance. We recommend using Styrolux NB and ASE batches for antiblock and slip. A HIPS with medium particle size is also suitable for use as an antiblock.

Welding and sealing temperatures should be approximately 270-330° F, with dwell times reduced by 40-60% compared to LDPE films.

Perforating should be carried out with sharp tools suitable for perforating elastomers.

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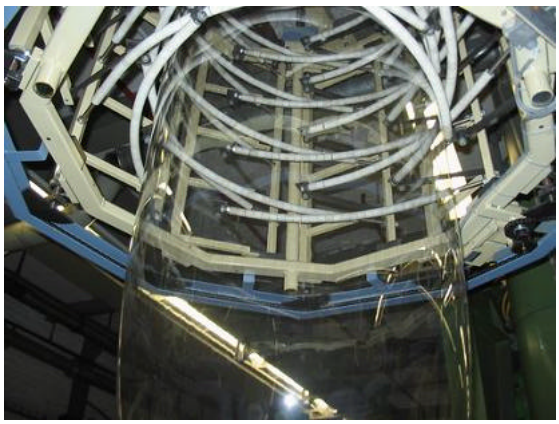
Physical Form & Storage

Styroflex is supplied in the form of pellets. The pellet softness and tackiness may cause the pellets to cluster if compressed or stored in hot conditions. However, such clusters are easily broken up mechanically. The storage temperature should not exceed 100°F. Prolonged contact with sunlight should be avoided, as UV radiation will cause the resin to turn yellow and loose some of its elastic properties. Due to its structure based on styrene and butadiene Styroflex has negligible water absorption.

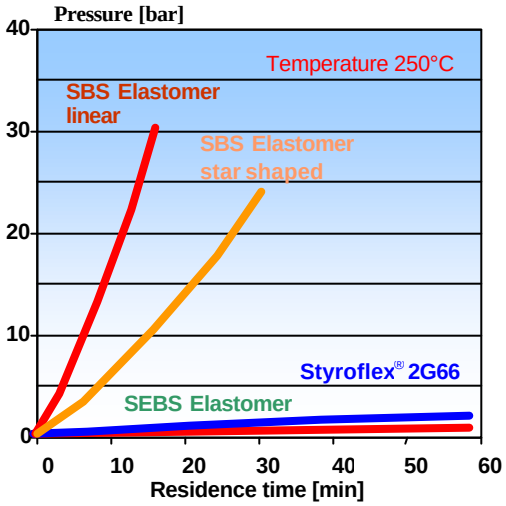
Typical properties of Styroflex 2G66 are as follows:

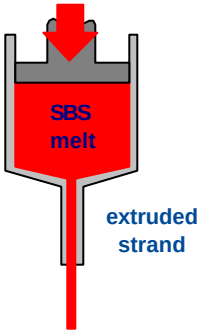
- Shore A hardness (3s) 15 s: (87) 84
- Shore D hardness (3s) 15 s: (33) 29
- Density: 0,99 g/cm3
- Vicat soft ening temperature: VST/A 35 ºC
- Transparency, 4 mm (ISO 5033): 80 percent
- MVR 200/5: 10 to 15 g/10 min
- Elongation at break (DIN 53455): >650 percent
- Tensile strength at break (DIN 53455): 33 MPa
- Tensile stress at 100 percent strain (DIN 53455): 2,7 MPa
- Charpy impact strength at 23 ºC (ISO 179/1eU): no break
- Glass transition temperature: -40 ºC
- Brittle temperature (DIN 53372): -35 ºC
- Torsional stiffness (DIN 53447): -41 ºC
- Compression set at 23 ºC (DIN 53517): 70 percent
- Compression set at 70 ºC (DIN 53517): 100 percent.



Thermal Stability

Thanks to its unique molecular architecture, Styroflex has very good thermal stability, even at very elevated processing temperatures.





No pressure increase
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Excellent thermostability of Styroflex® 2G66

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