

# SURPASS™

**film** resins

Processing Guide

# polyethylene

## PROCESSING CONSIDERATIONS FOR SURPASS BLOWN FILM RESINS

SURPASS resins for blown film are single-site catalysed, linear polyethylenes. NOVA Chemicals introduced the SURPASS FPs117 and HPs900 resin family to the marketplace as the first SURPASS products for blown film applications. This new family of SURPASS polyethylenes has similar dart, puncture and seal properties compared to conventional metallocene polyethylenes for blown film, with improved tear performance and processability.

### Equipment Considerations for SURPASS Blown Film Resins

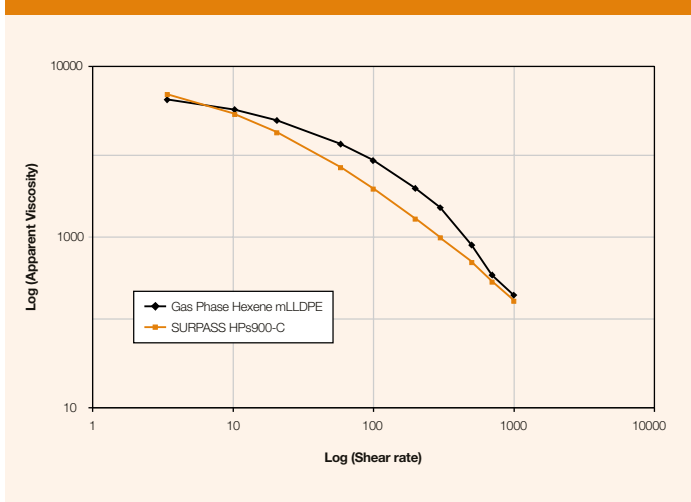
SURPASS polyethylene for blown film applications can be processed on blown film equipment designed for traditional, Ziegler-Natta (ZN) catalysed linear-low density polyethylene (LLDPE). A suitable screw design for SURPASS polyethylene is a barrier screw with mixing head. Extruder barrel lengths between 24:1 and 32:1 L:D are appropriate. SURPASS polyethylenes can be processed on both smooth bore and grooved feed extruders, with the appropriate temperature profile considerations for each barrel type.

SURPASS blown film resins are well suited for ZN LLDPE designed dies. Viscosity curves for SURPASS resins can be obtained from NOVA Chemicals Technical Center if new screws and/or dies are being considered with these resins in mind. SURPASS single-site LLDPEs (sLLDPE) benefit from dual-lip air rings and chilled cooling air for the most efficient processing results.

The SURPASS family of blown film resins are formulated with polymer process aid (PPA), and should be processed on dies with narrow die gaps, typically less than 0.060", to achieve the best efficiency from the PPA.

SURPASS blown film resins do not require special equipment consideration for collapsing, haul off, or winding versus standard LLDPE. SURPASS resins are less tacky than ZN LLDPE and are also more resistant to hot blocking than ZN LLDPE of the same density.

### Viscosity Comparison at 200°C (390°F)



Graph 1

### Evaluating the Processability Difference

The SURPASS FPs117 and HPs900 family of resins process at lower amperage and pressure than competitive metallocene LLDPE (mLLDPE) products of the same melt index. This improvement in processability can be used to increase output on extruders which are amp or pressure limited, or reduce the amount of low density polyethylene (LDPE) in a blend. Due to the enhanced processability of SURPASS resins versus metallocene LLDPEs, there is also more room to reduce melt temperature and improve melt strength without reaching the amp or pressure limit of an extruder. Improving the melt strength of the film will again allow either output improvements or LDPE reduction.

There are quantifiable benefits in economics for increasing extruder output. The reduction of LDPE in a blend is also a benefit in terms of physical property performance of the film.

The flow chart on the opposite page describes a standard SURPASS trial approach, which can be used to quantify the differences in processability between SURPASS blown film resins and competitive metallocene polyethylenes. This approach is valid for lines in which either pressure extruder amperage or screw speed are bottlenecks to throughput.

Although processability enhancements for SURPASS blown film resins can be expected versus metallocene LLDPEs, the processability of SURPASS blown film resins is equivalent to most ZN LLDPE film grades of the same melt index (MI). Therefore, no output enhancements or LDPE reduction benefits are expected when SURPASS blown film resins are compared to ZN LLDPE. Typical benefits of SURPASS blown film resins versus ZN LLDPEs are realized in the toughness, seal and, in some cases, optical properties.

### Melt Temperature Adjustment

Both ramp and hump temperature profiles are suitable for processing SURPASS sLLDPE, along with ZN LLDPEs and competitive mLLDPEs. A typical hump temperature profile for LLDPE blown film starts with a first zone temperature between 170 and 190°C (340 and 375°F). The second and sometimes third zone (if the extruder includes 5 or more zones) is set to the desired melt temperature. The remaining zones then step down in temperature set point by approximately 10°C (20°F).

A typical ramp temperature profile for LLDPE blown film starts with a temperature between 170 and 190°C (340 and 375°F), and then increases in temperature along the zones by approximately 10°C (20°F). There are many variations of these typical temperature profiles used in the industry, and there is no one correct temperature profile.

To adjust the melt temperature of SURPASS resin down when a hump temperature profile is employed, step down the barrel temperatures in 5 to 10°C (10 to 20°F) increments. Do not decrease the first zone below 150°C (300°F). The die body temperature should also be reduced.

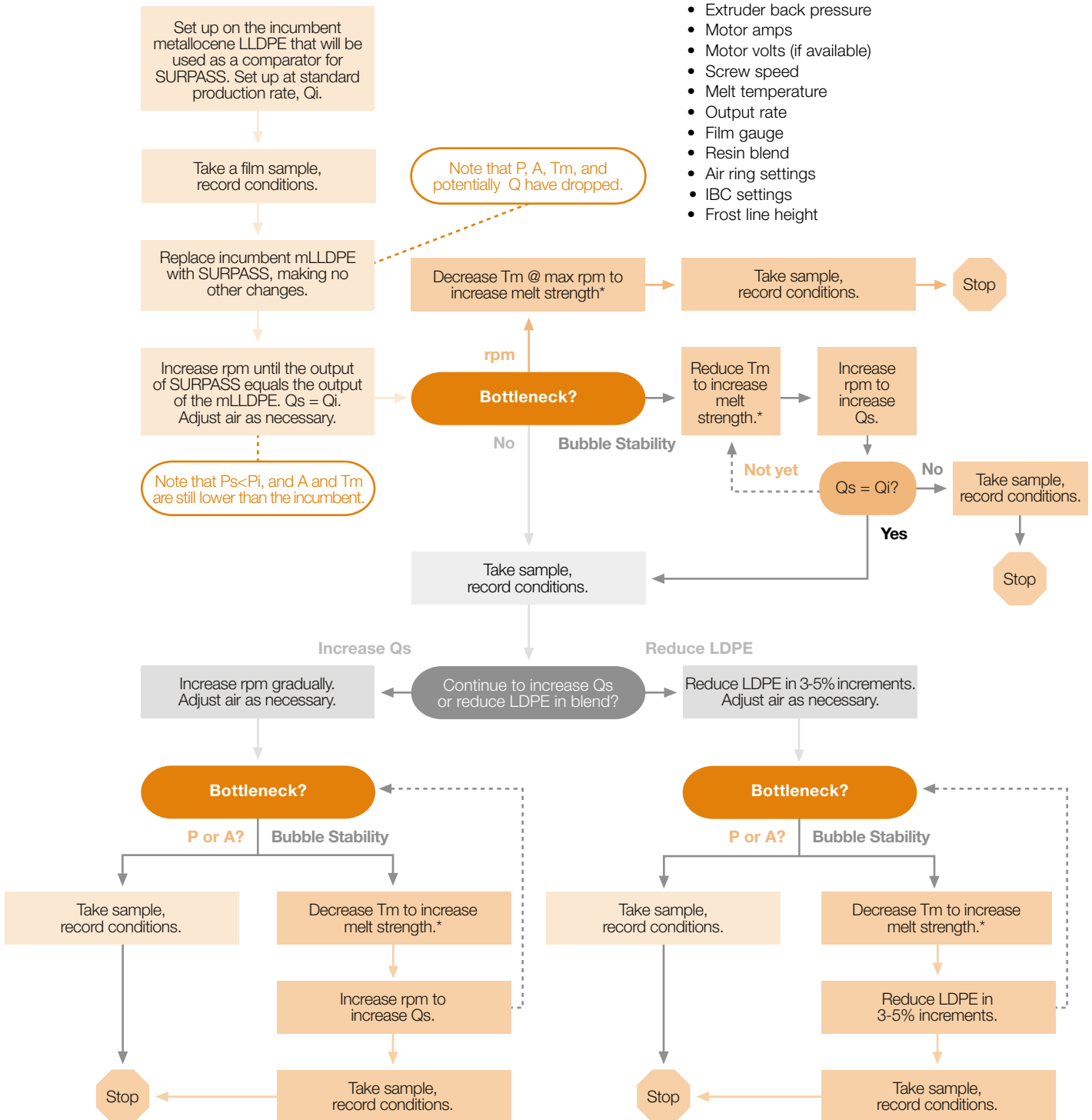
To adjust the melt temperature of SURPASS resin down when a ramp temperature profile is employed, step barrel temperatures down in 5 to 10°C (10 to 20°F) increments. Do not decrease the first zone below 150°C (300°F). The die body temperature should also be reduced. If melt temperature does not decrease, this indicates that shear heating is the predominant method of heat generation in the barrel. In this case, switching to a hump temperature profile should help.

**For further information or assistance** evaluating the processability benefits of SURPASS polyethylene, please call the NOVA Chemicals Technical Center at 403.291.8444 and ask to speak with a Technical Service Specialist in film.

## TRIAL PATH FOR COMPARISON OF SURPASS sLLDPE TO CONVENTIONAL mLLDPE

### Standard items to record for each sample

- Temperature profile set points and actual reading
- Extruder back pressure
- Motor amps
- Motor volts (if available)
- Screw speed
- Melt temperature
- Output rate
- Film gauge
- Resin blend
- Air ring settings
- IBC settings
- Frost line height



### Flow Chart Glossary

**Q** = output  
**P** = extruder back pressure  
**A** = extruder load (amperage)

**T<sub>m</sub>** = melt temperature  
**Subscript i** = incumbent metalocene LLDPE  
**Subscript s** = SURPASS FPs117 or HPs900 sLLDPE

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