

Eastman Spectar™ Copolyester

Some Tips on Extrusion of Plastic Sheet

D u r a b i l i t y . S u s t a i n a b i l i t y . F l e x i b i l i t y .

Drying

- Dry Spectar™ copolyester at least 6–10 hours at 65°C (150°F) using a desiccant dryer. Insufficient drying will cause excessive molecular weight loss during extrusion, with resultant decrease in physical properties. Additionally, moisture will often cause bubbles to form in the sheet. Drying time must be adjusted according to incoming pellet moisture. Target pellet moisture level should be <0.04%.
 - Use a dryer that will deliver air having a dew point temperature of minimal –30°C to –40°C (–20°F to –40°F).
 - Use a hand-held, portable dew point indicator to routinely monitor the actual dew point of each desiccant bed and to verify that permanently mounted indicators are properly calibrated.
- NOTE:** The dew point should be checked at the hopper inlet.
- Use a dryer that will deliver air at a velocity of 0.06 m³/min per kg/h (1 cfm per lb/h) of pellets being processed.
 - Maintain drying equipment properly. It is critical to check regeneration temperatures, process temperatures, filters, and airflow.
 - Properly dry all additives that will be blended and extruded with Spectar™ copolyester.
 - Utilize a properly designed dryer hopper that promotes good airflow throughout the pellet bed.
 - Properly size the dryer hopper to obtain required residence time. (Spectar™ copolyester's bulk density is: poured—45 lb/ft³, vibrated—50 lb/ft³.)
 - Do not exceed a drying temperature of 65°C (150°F) because softening and caking of the pellets will occur in the drying hopper.
 - Do not use multiple drying hoppers that share one drying system, unless there is a means of measuring airflow and dewpoint to each hopper.

Equipment

- Use extruders having L/D ratios of at least 24:1. Outputs expected are generally in the range of 2.4 to 4.3 kg/h per kW (4 to 7 lb/h per horsepower).
- Use a low-compression barrier screw. Screws used for PVC, PC, acrylic, or styrene have been used with Easman Spectar™ copolyester with some degree of success. For best results, the screw should be designed specifically for Spectar™ copolyester.
- Use internal screw cooling in the first few feed flights of the screw to facilitate feeding and prevent bridging; end cooling before heater zone 1 on the extruder.
- Use a 24-40-80-40-24 mesh screen pack. The screen pack configuration/mesh may need to be adjusted, depending on the amount and quality of regrind.
- Use a coat hanger, flexible-lip sheet die with a long land length; for example, an 89-mm (3.5-in.) land would be typical for 6.5-mm (250-mil) sheet. For startup, the die lip gap should be at least 25% wider than the desired sheet thickness. All flow surfaces should be polished to a finish of 2 RMS or better.
- The die face should be designed to allow the die to be positioned **as close to the nip** (i.e., contact point of rolls) **as possible** to minimize roll contact prior to nip.
- Use standard 3-roll sheet stacks [305-mm (12-in.) minimum roll diameter] for producing nip-polished or “kiss-polished” sheet. These stacks can be vertical, horizontal, or any angle in between.
- Use **sharp**, rigidly mounted knives for trimming edges.

- Use a shear having minimal rake, a 1 relief on the blade face, an 87° blade angle, and a 0.076- to 0.127-mm (3- to 5-mil) tolerance between blades.
- Do not use high-shear mixers. These can cause excessive melt temperatures.
- Do not use a restrictor-bar die, if possible. A restrictor-bar may be needed for wide dies or if a wide range of materials and thicknesses will be processed. This becomes more of a factor in the heavier gauges [e.g., 6.4 mm (0.250 in.)].
- Do not use a die having nicks or scratches in the die lips or other flow surfaces.

Extrusion Procedures

- Start with a completely clean hopper, extruder, and die before processing Spectar™ copolyester.
- Extrude at the minimum melt temperature that can be used to produce acceptable sheet. Thicker sheet is extruded at lower melt temperatures. Typical melt temperatures are between 225°C and 260°C (440°F and 500°F). An excessive melt temperature will reduce melt strength, resulting in various surface imperfections.
- Clean extremities of die lips thoroughly and apply silicone spray release agent to these areas before starting the extrusion line. Otherwise, the polymer may stick to the die lips, causing drag or flow lines in the sheet.

- Use a prethreaded leader of clean, soft cotton cloth void of any sizing or other materials that may transfer or stick to the hot roll surfaces in the takeoff unit to facilitate an easy, rapid, and clean start-up.
- Use chill roll temperatures that are 3°C to 5°C (5°F to 10°F) below the temperature at which sticking will begin to occur. This temperature will be different for each roll and will be dependent on sheet thickness, extruder output, surface finish, and diameter of the chill rolls. The middle roll would typically be approximately 7°C (20°F) hotter than the opposing nip roll to keep the sheet on the middle roll.
- Do not allow the extruder to sit idle for long periods at operating temperatures with material still inside the barrel.

Note:

The information provided in this publication is intended as guidance for a typical production operation. Differences in manufacturing processes, equipment, and personnel may require the user to modify the guidelines accordingly. It is the responsibility of the users to determine for themselves if these guidelines are safe and technically suitable for their specific operations.

Other publications containing in-depth information on extrusion of plastic sheet from Eastman Spectar™ copolyester are available.

Conversions of metric/U.S. customary values may have been rounded off and therefore may not be exact conversions.

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