



COMPOSITES FREQUENTLY ASKED QUESTIONS

Internal Mold Release for Pultrusion

MIXING GUIDELINES

How much internal mold release should I mix into the resin for testing?

The amount of internal mold release added is measured in terms of parts per 100 resin, by weight (phr). This is based on the unfilled (neat) resin. For example, adding 1.0 phr of internal mold release means that 1 part of internal mold release is added to 100 parts of the neat resin.

The amount of internal mold release will vary depending on the resin formulation. The type of resin, concentration of fillers and pigments, and die geometry can all affect the necessary amount of internal mold release required.

Generally, a typical polyester pultruded stock may use 0.25–2.0 phr of internal mold release whereas an epoxy pultruded stock may use 1.0–3.0 phr of internal mold release. It is generally recommended to start at a higher level for testing and reduce to lower levels to optimize while in production.

Chem-Trend has performed extensive testing in its labs, and has established starting points and relevant ranges for each of its internal mold releases. See the product datasheet for suggested loading levels of each Chemlease® product.

When should I add the internal mold release to the resin mixture?

Order of addition is another important consideration.

If the order of addition has already been established using an existing internal mold release, using the same order is a sensible starting point.

If this is a completely new program, it is generally advisable to add the internal mold release before the initiator/catalyst and before the addition of fillers and pigments. This ensures sufficient absorption of the internal mold release into the resin.

What if I am using a two-part resin system?

If adding to an epoxy resin system, it is generally advised to add the internal to the less viscous component, resin or hardener, before mixing the two components.

If adding to a polyurethane resin system, it is generally advised to add the internal to the polyol component, before adding the isocyanate.

In the case of two-part resin systems, it should be noted that 1.0 phr means 1 part of internal mold release to 100 parts of the two-part resin mixture (resin + hardener).

PRE-TRIAL TESTING GUIDELINES

What tests are appropriate to ensure compatibility and good performance of the internal mold release, in advance of a production trial?

Gel Time is the first property one should test for to ensure compatibility of the internal mold release and resin mixture. In pultrusion, testing gel time using a heated water batch, to measure SPI gel time, is generally recommended.

Please reference ASTM D7029 or ISO 584 for test method details.

Viscosity is another attribute which can be tested using a viscometer or similar test equipment. Internal mold releases generally reduce the viscosity of the resin mixture, which aids in impregnation of fibers and proper wetting of additives and fillers. Viscosity is also an important consideration in pultrusion processing, which impacts pull force, line speed and surface finish.

Glass transition temperature (T_g) of the cured resin is an important predictor of mechanical properties of the composite material. T_g can be measured via an analytical test such as differential scanning calorimetry (DSC). Impact on cure kinetics can also be assessed using the same technique.

TRIAL TESTING GUIDELINES

What tests are appropriate to ensure acceptable performance on the pultrusion line?

Pull Force can typically be measured in real time using a programmable logic controller (PLC) configured to the pulling equipment.

Line Speed can be measured in real time using a PLC. Or, it can simply be calculated as an average line speed, based on the number of linear feet/meters produced during the trial time period. It is recommended this time period begin once reaching a steady state in production.

Die wear/life can also be assessed using precise measurement equipment. Please consult Chem-Trend for more information and methods for evaluation, specific to your application.

POST-TRIAL TESTING GUIDELINES

What tests are appropriate to ensure compatibility, post molding?

Visually evaluate the pultruded stock for exposed fibers and other surface defects. ASTM D4385 provides a test method for doing so.

If the pultruded stock off the line represents the final finish, then evaluating the part for color is important.

If the pultruded stock is to be painted, performing a paint adhesion test using a cross-cut technique, as with the ISO 2409 method, is generally used.

IMPORTANT

The use of an internal mold release agent may adversely impact the overall properties of the finished part. Therefore, it is the responsibility of the user of the internal mold release agent to determine if there are any adverse effects to part quality determined through testing.

Just one more way Chem-Trend is innovating to make our customers more efficient, more productive, and more sustainable. To learn more about Internal Mold Release solutions for Composites, contact your local Chem-Trend office.

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