Rynite® PET

thermoplastic polyester resin

Development of Viscosity Retention Guidelines for Parts Molded from Rynite® PET

Almost all resins will change in viscosity upon molding. Some resins will increase in viscosity, but most will decrease. This change from the resin to the molded part can be expressed as the ratio of the part melt flow rate or melt viscosity to that of the resin. For a typical viscosity decrease, this molding ratio will be greater than one when measured as melt flow rate and less than one when measured as melt viscosity. The magnitude of the change for parts molded from Rynite® PET depends upon the combined effect of several variables:

- Molecular weight change
- Filler attrition
- Molecular interaction/reaction/cross-linking

Excessive viscosity changes that significantly affect properties can be avoided by controlling molding conditions to minimize effect of these variables.

Viscosity change upon molding can be related to standard physical properties of test bars, such as impact, tensile, and flexural strength. This requires exhaustive studies to separate the effects of resin moisture, barrel residence time, and melt temperature for each resin. Even when these data are in hand, choosing an acceptable level of property retention is arbitrary and may not be appropriate for all parts.

Acceptability of a part, the basis for quality control, depends upon whether the molded part meets end-use requirements and not upon property retention in test bars. This is because different parts will require different properties, even when the same resin is used, because the true limiting viscosity will depend upon part design and tooling considerations, such as gates, runners, and flow path for a given mold and molding machine. Ultimately, any effective quality control test must be referenced to part performance. For a given part, viscosity retention provides a simple, practical means to check the quality of molded parts after this baseline of viscosity versus part performance has been established.

General viscosity guidelines for a well-molded part are sometimes required before these part performance criteria have been established. As a substitute for optimum quality control, the molding ratio or a part guide limit for a given resin can be a useful reference. However, using a simple universal limit for a material risks either excessive rejects or part failure with some parts, because this assumes that “catastrophic” failure always occurs past a certain point, regardless of the type of part.

Table 1. Summary of General Rynite® PET Viscosity Molding Ratios

		Melt Indexer			Melt Viscosity			
Resin	Weight, g	Poor	Marginal	Good	Poor	Marginal	Good	Part Limit
530	2160	>4.0	3.0–4.0	<3.0	<0.50	0.50–0.65	>0.65	120
545	2160	>4.0	3.0–4.0	<3.0	<0.50	0.50–0.65	>0.65	130
555	2160	>4.0	3.0–4.0	<3.0	<0.50	0.50–0.65	>0.65	140
935	5000	>6.0	3.0–6.0	<3.0	<0.50	0.50–0.65	>0.65	145
940	5000	>6.0	3.0–6.0	<3.0	<0.50	0.50–0.65	>0.65	150
408	5000	>6.0	4.0–6.0	<4.0	<0.60	0.60–0.70	>0.70	170
415HP	2160	>3.0	2.0–3.0	<2.0	<0.60	0.60–0.70	>0.70	120
SST35	5000	>14	5.0–14	<5.0	<0.60	0.60–0.70	>0.70	175
FR330	2160	>9.0	2.5–9.0	<2.5	<0.55	0.55–0.65	>0.65	105
FR515	2160	>3.0	2.0–3.0	<2.0	<0.65	0.65–0.75	>0.75	90
FR530	2160	>3.0	2.0–3.0	<2.0	<0.65	0.65–0.75	>0.75	120
FR543	2160	>6.0	4.0–6.0	<4.0	<0.65	0.65–0.75	>0.75	135
FR943	5000	>4.5	2.5–4.5	<2.5	<0.65	0.65–0.75	>0.75	150
FR945	2160	>8.0	2.5–8.0	<2.5	<0.65	0.65–0.75	>0.75	140
FR946	2160	>3.5	2.5–3.5	<2.5	<0.65	0.65–0.75	>0.75	170

$$\text{Molding ratio} = \frac{\text{part value}}{\text{resin value}}$$

The guidelines in **Table 1** reflect primarily the quality of molding NOT part performance. They can be used as a guide while part performance versus viscosity retention data is being developed.

Poor: The viscosity change is greater than normally seen. A very high probability is that parts will be brittle.

Marginal: The viscosity change is typical for many parts and processes, but the process should be examined carefully to look for ways to improve.

Good: The viscosity change is as low as can typically be expected. If parts still break, then design changes are needed.

Part Limit: Used when a resin sample is not available. Parts with viscosities above this value have generally been molded well.

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