TECHNICAL UPDATE

CRAY VALLEY
A BRAND OF TOTAL

Cleartack® Resins as PVC Processing Aids

Benefits

- Improved thermal stability
- Increased impact strength
- Good surface quality

Description

Polyvinyl chloride (PVC) is an important durable material used in many applications including outdoor building applications. Due to the high rigidity and modulus of PVC, it is often used in construction applications such as windows and siding. One of the drawbacks of PVC is thermal sensitivity, which leads to a narrower process window than other polymers. Because of this thermal sensitivity, processing aids are commonly used to enable easier processing of the PVC. Historically, these processing aids were acrylic based. A new development from Total Cray Valley is the use of Cleartack® resins as process aids in PVC. Cleartack resins are low molecular weight polymers based on the polymerization of aromatic hydrocarbons. Using Cleartack instead of a traditional acyclic processing aid improves thermal stability, impact strength, and surface quality. Cleartack is offered in pastilles and a new powdered form.

Formulations and Testing

Cleartack resins used as process aids reduce torque and shear heating. Table 1 shows the formulation of rigid PVC used in this study.

Table 1. Formulation of the rigid PVC tested.

Material	PHR
Shintech Se 950 PVC resin (0.92 IV / 66K)	100
Advastab TM-181 tin stabilizer	1.3
Ferro 15F calcium stearate	0.6
Ferro 165 paraffin wax	1.2
Lonza Lonzest™ GMS ester wax	0.3
Arkema Durastrength® 200 impact modifier	6
Pigment	10-12
Cleartack W-110	1
Cleartack W-140	
Acrylic processing aid	

A torque rheometer was used to compare the fusion performance of Cleartack W resins and an acrylic processing aid. Table 2 shows that Cleartack reduces fusion temperature by up to 7 °C and torque by 12%.

Table 2. Fusion performance of Cleartack W-110, W-140 and an acrylic processing aid.

	W-110	W-140	Acrylic
Fusion Time (s)	60	62	62
Fusion Torque (mg)	1590	1530	1740
Fusion Temperature (°C)	170	173	177

Thermal stability was measured using a torque rheometer following ASTM D2538. Cleartack outperforms the acrylic standard by over 10 minutes at 180 °C, as shown in Figure 1.

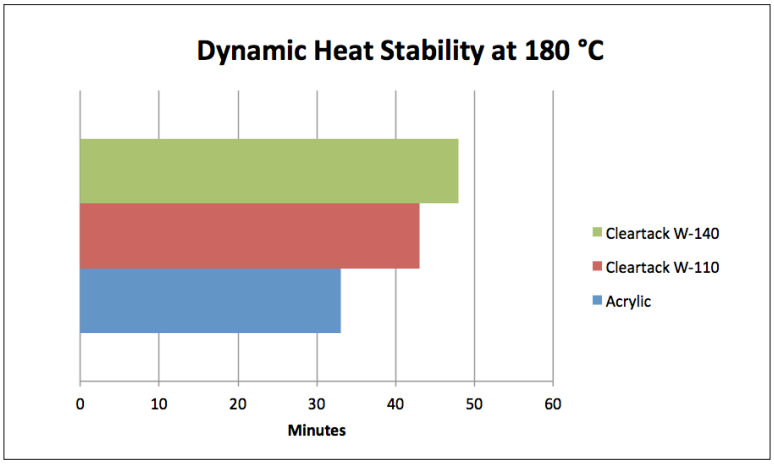
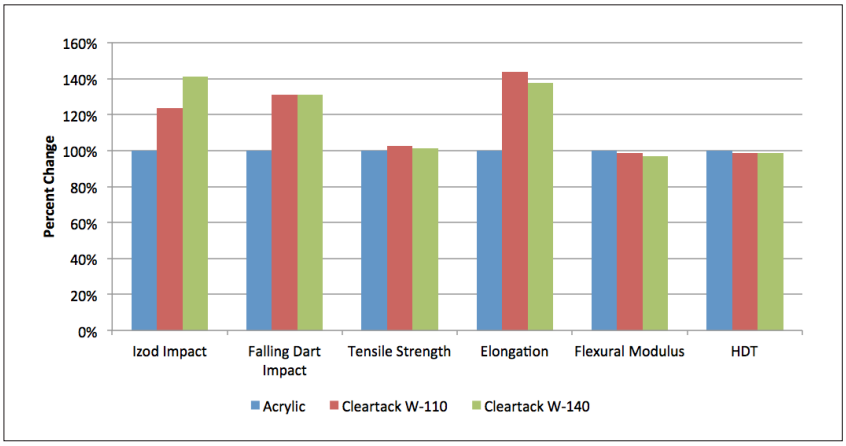


Figure 1. Heat stability at 180 °C, following ASTM D2538.

Cleartack W resins improve Izod impact and falling dart impact by 40% and 30%, respectively, and maintain tensile, flexural, and heat distortion temperature (HDT) properties when used as processing aids, as shown in Figure 2.



	Izod Impact (ft-lbs/in)	Falling Dart Impact (in-lbs/mil)	Tensile Strength (psi)	Elongation (%)	Flexural Modulus (ksi)	HDT (°C)
Acrylic	1.7	1.6	7600	16	423	75
Cleartack W-110	2.1	2.1	7800	23	417	74
Cleartack W-140	2.4	2.1	7700	22	409	74

Figure 2. Physical properties shown as percent change in chart and actual values in table for acrylic processing aid versus Cleartack W resins. Data generated using ASTM D256, ASTM D638, ASTM D790, and ASTM D648.

Cleartack and acrylic processing aids were compounded into white and brown compounds, and extruded into sheets, then cut into strips for testing resistance to weathering. Gloss retention and color change were monitored over 2000 hours. Both the acrylic processing aid and the Cleartack W resins gave similar weathering performance as shown in Tables 3 and 4. Weathering was tested using a QUV with method G154 cycle 1/0. Gloss was tested in accordance with ASTM D523.

Table 3. 60° gloss measurements as molded and after 2000 hours of accelerated weathering by ASTM D523 method.

	W-110	W-140	Acrylic
As molded	92.7	92	89.9
After weathering	44.2	37.6	41.5
Retention	50%	42%	48%

Table 4. Delta E color after 2000 hours of accelerated weathering by ASTM D523 method.

	W-110	W-140	Acrylic
White	3.41	4.07	3.28
Brown	0.4	0.35	0.27

Summary

Cleartack W resins improve PVC processability by reducing torque and shear heating compared to acrylic processing aids. Cleartack W resins also improve impact properties and provide a better surface quality while maintaining physical properties and weatherability.

For more information, please visit **www.crayvalley.com**

About Total Cray Valley

Total Cray Valley is the premier global supplier of specialty chemical additives, hydrocarbon specialty chemicals, and liquid and powder tackifying resins used as ingredients in adhesives, rubbers, polymers, coatings and other materials. Total Cray Valley has pioneered the development of these advanced technologies, introducing hundreds of products that enhance the performance of products in energy, printing, packaging, construction, tire manufacture, electronics and other demanding applications.

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