RIMLINE® polyol / SUPRASEC® MDI

Polyurethane Resin System for Pultruded Composites

Typical Processing Equipment and Conditions:

RIMLINE pultrusion systems are ideally processed on low pressure metering equipment consisting of two material components and a flushing solvent. This low-viscosity system offers multiple advantages in the pultrusion process including excellent wetting of reinforcements, fast reaction kinetics and low pull forces while providing good surface quality at accelerated line speeds with minimal VOCs. Extended gel times of the Huntsman system allow for ease of start-up and system purge.

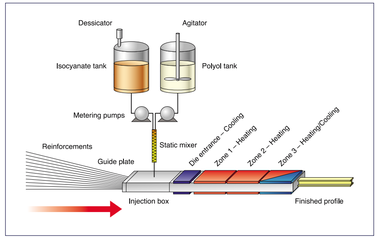
Processing requirements:

- Temperature controlled die between 160 - 200°C
- Closed injection box
- Two-component metering pump and static mixer

PU benefits:

- Line speed up to 2.5 m/min
- Excellent wetting characteristics
- Low pull forces
- Good part surface quality
- Minimal emissions

Schematic of a Typical Polyurethane Pultrusion Set-up



www.huntsman.com/pu/pultruded_composites

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For your protection

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Polyurethanes

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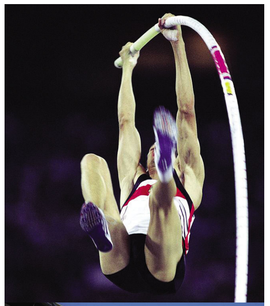


Huntsman Polyurethanes' resin for pultrusion is a fully formulated two-component system based on RIMLINE polyol and SUPRASEC MDI isocyanate, offering excellent wetting characteristics, accelerated line speeds, low pull forces and minimal VOC emissions. The resin system is well suited for structural profiles in demanding applications where superior strength and durability is a requirement.

Typical applications:

- **Sporting goods**
- **Window lineals**
- **Architectural moldings**
- **Flat springs**
- **Lightweight structural supports**
- **Stabilizer bars**
- **Transportation panels**

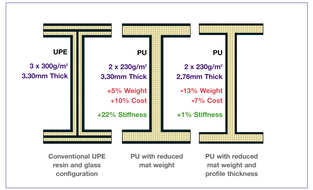
Properties:

- **Superior strength**
- **Durability**
- **Impact resistance**
- **Heat distortion**
- **Damage resistance**

The toughness, damage tolerance and strength of polyurethane resins bring potential to simplify and reduce the cost of the reinforcement layup in pultrusion profiles by replacing mat with rovings. Further, converting mat to rovings in the design will increase profile stiffness and liberate the potential to reduce the overall composite geometry.

Depending on design intent, structural components may be fabricated to take advantage of either the higher stiffness at constant cross-section or lower weight and cost with reduced wall thickness. This design latitude will aid the pultruder and end-user in remaining cost competitive, differentiating their product offering and growing into new market opportunities.

Comparison of Cost, Weight and Stiffness of Unsaturated Polyester (UPE) Resin versus Polyurethane (PU) resin in I-Beam with Various Glass Configurations and Profile Thicknesses



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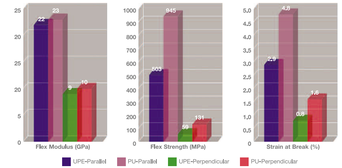
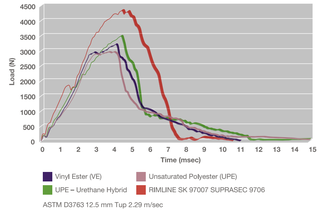
Incorporation of glass mat reinforcements with glass rovings improves transverse properties in a pultruded composite. As illustrated below, a flat profile with mat reinforcements on the surface exhibits superior flexural properties when pultruded in a polyurethane resin versus an unsaturated polyester resin.

Comparison of Flexural Properties of Unsaturated Polyester (UPE) and Polyurethane (PU) Pultruded Profiles



Dynatup Instrumented Impact (12.5 mm tup)



ASTM D3763 12.5 mm Tup 2.29 m/sec

Dynatup instrumented impact curves are compared for identical composites of each resin system. As with the tensile properties, the PU composite displays superior toughness relative to the Vinyl Ester (VE), UPE and UPE-urethane hybrid resin profiles. In this type of experiment, the area under the curve indicates the total energy absorption during dart penetration and the area up to the maximum load reveals the impact energy absorbed before catastrophic failure.

For processes such as cutting and assembly, the toughness and durability of polyurethane composites can pay dividends in terms of reduced scrap, ease of assembly, decreased labor or reduced assembly cost. The force to remove a #10 (2.5 mm diameter) self-tapping screw was measured and as with mechanical properties and damage tolerance, RIMLINE polyurethane profiles exhibit significantly higher performance than the competitive resins. In addition the force to initial crack formation shows even more pronounced differences, an important factor for profiles subjected to repeated loading over time.

Screw Pull-Out Force for Vinyl Ester (VE), Unsaturated Polyester (UPE), Unsaturated Polyester-Urethane Hybrid and Polyurethane Pultruded Profiles