GThurm Window Systems Highlights Sheet

The Graham Architectural Products' new product incorporates a pultruded continuous strand *glass reinforced polyurethane* (GThurm). GThurm window sash/frame lineals represent a significant advance in material performance over the current best technology for architectural grade windows.

Best-in-class Thermal Efficiency

GThurm thermal performance is nearly double that of any other AW rated product. GThurm windows, employing triple pane, insulated glass, have achieved U values as low as 0.18, which translates to R5.5. Currently, even the best aluminum architectural grade windows can only provide U values in the .35-.50 (R2.85 – R2.0) range using the same glass.

Superior Strength

G2RP™ TECHNOLOGY

Graham's GThurm is made using our G2RP technology and features a composition of 80% continuous strand glass reinforcement with 20% polyurethane vs. 55% glass in fiberglass pultrusions (FRP). The higher percentage of glass incorporated into the GThurm and the polyurethane binder is what gives GThurm windows their superior strength characteristics. Traditional pultrusion materials like fiberglass (FRP) have not been capable of meeting the more demanding requirements of the architectural window markets with AW class windows. Here is where the superior transverse strength of polyurethane permits complex parts to be pultruded without the costly need to use woven or non-woven mats and veils.

Polyurethane offers many advantages compared to the traditional polyester, vinyl ester and epoxy materials:

- Highest ratio of glass vs. resin content – increases strength at a lower cost
- Improved impact and transverse (crosswise) properties
- Higher specific strength and stiffness (flexural modulus) – lighter and more economical profiles can be manufactured due to strength advantages
- Lower resin costs vs. vinyl resin and epoxy
- Elimination of the need for mats – the "rovings only" composition reduces complexity of operation and neutralizes cost advantage of polyester
- Elimination of VOC's in manufacturing process
- Screw fastener pull-out strength approaching that of aluminum

Better Sealing Characteristics

In addition to higher strength, a further advantage of high glass content in GThurm lineals derives from having identical expansion properties for the framing material and the Insulated Glass Units (IGU's) thus eliminating movement between the two - a primary cause for sealing failure in windows.

Environmentally Friendly

The GThurm pultrusion processes uses polyurethane resin and releases no volatile organic compounds (VOC's) as opposed to the unsaturated polyester resins, or vinyl esters, used in making fiberglass reinforced polyester (FRP).

Sustainable Design

GThurm lineals use 57% less energy per pound of raw material [1] [2] [3] [4] to produce than comparable aluminum designs. GThurm windows not only save energy when installed, they take less energy to produce, conserving our natural resources and reducing carbon emissions. This gives our GThurm window products a reduced carbon footprint compared to comparable architectural grade offerings.

References Cited

[1] Aluminum window frame: Calculated by using process data from GaBi software, Aluminum extrusion profile, software and database for life cycle engineering-GaBi, PE International. GmbH, 2008
[2] Composites window frame: Calculated by using process data from GaBi software, Fiberglass: Glass fibre, Germany (2005), software and database for life cycle engineering-GaBi, PE International. GmbH, 2008
[3] MDI: PlasticsEurope, MDI Plant, Europe Average (2005), software and database for life cycle engineering-GaBi, PE International. GmbH, 2008
[4] Polyols: Polyether Polyol Plant, PlasticsEurope (2005), software and database for life cycle engineering-GaBi, PE International. GmbH, 2008