New continuous-fibre thermoplastic technology for rail car application

Because we have more than 75 years of experience in the industry, some readers might think the authors of this article are like post-cure thermoset composites - rigid and set in their ways. They will be surprised to see the new panels we have developed for refrigerated rail cars made with continuous-fibre reinforced thermoplastics.

The benefits to end-users - rail car manufacturers and the transportation companies that buy them - are stronger and more scuff-resistant panels. The benefits to our companies - the materials consolidator and panel fabricator - include a consistent, sealed laminate surface and a cleaner, more environmentally-friendly process that employees like to work with.

**Manufacturing steps**

The manufacturing process begins at Polystrand in Montrose, Colorado, USA, where continuous E-glass fibres are impregnated with polypropylene thermoplastic resin to make ThermoPro™ X-Ply™ reinforcement tapes. Polystrand ships the material in rolls which are 60% continuous fibres by weight, aligned in a 0°/90° orientation.

At Miles Fiberglass & Composites in Portland, Oregon, USA, two rolls of Polystrand® reinforcing material feed a laminating and forming process that heats, bonds and shapes the corrugated panels.

Miles ships the corrugated panels to a nearby Oregon facility where Gunderson Rail Services, a business of The Greenbrier Companies, Inc., installs the panels in railroad freight cars they outfit for transporting frozen and perishable products. The cars are being built under contract for Cryo-Trans, Inc., a company specializing in the leasing of refrigerated boxcars.

Once the panels are installed in the rail cars, urethane foam insulation is injected into the cavity between the panels and the exterior walls. A consistent, sealed surface is important at this stage because the absence of pinholes keeps the expanding foam insulation from coming out through the laminate. The corrugated shape adds strength and allows cold air to circulate within the car and around the cold cargo when the rail cars are in use.

Although the companies have both been in the composites business for many years, this application brought them together for the first time. They met after Dick Holland of Composites One, the US distributor serving both of them, recognized that one company's product could perhaps help improve the other company's product.

While Polystrand is only two years old, the company was formed after more than a dozen years of development work with advanced composite materials. The company was established after a proprietary process was developed to thoroughly impregnate continuous fibres with thermoplastic resin.
In a two-month period, Miles will make nearly 30,000 corrugated panels that are 3.66 m long and either 0.762 or 0.914 m wide. The corrugated and other panels made by Miles will equip 429 rail cars. The entire contract will keep the company's employees busy for about a year.

The Polystrand reinforcement product is also being evaluated for internal bulkhead liners and threshold plates of truck trailers, which forklifts can damage during loading and unloading. The material shows great promise in this application as well.

While the truck application and others are being developed, Polystrand is expanding capacity to meet anticipated growing demand. The company now has two production lines with the ability to make 31.75-cm-wide tape. This summer, the company will add a third production line making 63.5-cm-wide tape. Although we don't expect traditional thermoset composites to disappear, these old dogs expect to see a lot more use of continuous-fibre-reinforced thermoplastics in the years ahead.