

Hexcel's Composite Materials for the Rail Industry



4 HexWeb®
Honeycombs



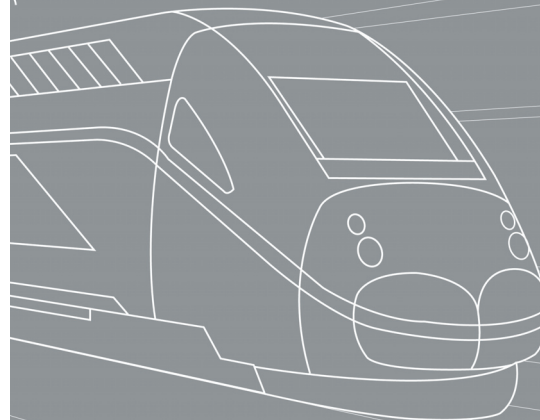
4 Hexply®
Prepregs



5 HexForce®
Engineered
Fabrics



5 Redux®
Adhesives





HexWeb® Honeycombs



Redux® Adhesives



Hexply® Prepregs

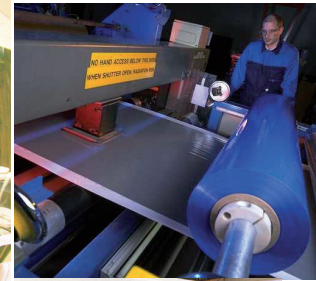


HexForce® Engineered Fabrics

About Hexcel

Composite materials were first used in the railway industry back in the 1970's, when Hexcel supplied honeycomb, adhesives and fibre-reinforced plastic materials for use in train ceilings, floors and doors. These early composite components were fitted into French, Italian, British and Austrian urban trains, as well as the metro systems of London, Lille and Hong Kong.

In the past 30 years, Hexcel has developed a wider range of composite materials, specifically to meet the requirements of the rail industry. The applications have diversified to include components as varied as structural floor panels, energy absorbers, front end cabs, composite bogies and full composite interiors.



An Unrivalled Product Range



HexWeb® Honeycombs

Hexcel has manufactured this most effective lightweight structural core material for over 50 years. Today we are the world's largest manufacturer of honeycomb in aluminium, Nomex, glass fibre and speciality materials. Honeycomb provides structural stiffness for flooring, partitions and furnishings, for very little weight gain.



Redux® Adhesives

Adhesives are useful in any joining application where weight saving is a priority as they reduce or remove the requirement for mechanical fasteners or welding. They also provide strength to the structure. Hexcel manufactures structural adhesives in film form, which is ideal for bonding metal to metal or composites.



HexPly® Prepregs

As the leading formulator of prepreg resins, Hexcel has developed prepregs speciality for the manufacture of structural rolling stock components. Hexcel's low temperature curing prepregs are the most effective composites for the manufacture of drivers cabs, bogies and energy absorbers.



HexForce® Engineered Fabrics

Hexcel has extensive in-house weaving capabilities for the manufacture of unidirectional and woven reinforcement fabrics in glass, carbon and aramid fibres and hybrids. The wide range of weave styles includes standard weaves and multiaxials.



HexWeb® Honeycombs

For improved bonding and higher shear loading than foams

HRH78 / A10

Phenolic dipped Nomex honeycomb for low weight and fire resistance.

CRIII & ACG

Aluminium honeycomb for energy absorption and low weight panels.



HexPly® Prepregs

Replacing noxious wet lay-up systems

M9-M10

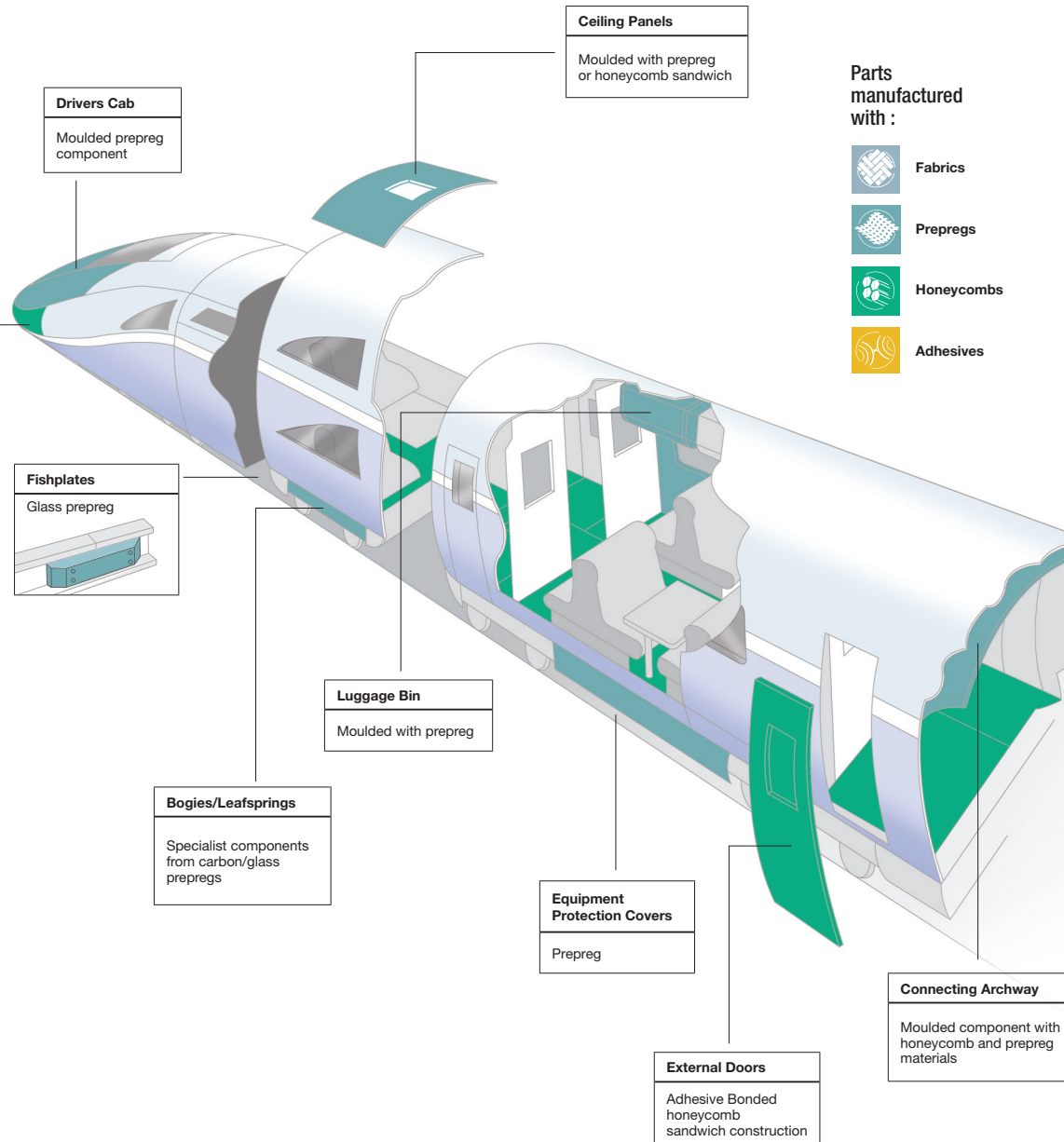
85°C curing epoxy system, suitable for fishplates and bogies.

M34





75°C curing system. Halogen free, fire resistant, suitable for end cabs, and other large structures.

250 CB

Phenolic prepreg. Fire-resistant.



Parts manufactured with :

-  Fabrics
-  Prepregs
-  Honeycombs
-  Adhesives

HexForce® Engineered Fabrics



3K, 6K, 12K carbon woven fabrics.
 Glass fabrics (from 25 to 600 gsm).
 Aramid fabrics.
 Carbon multiaxials.

Redux® Adhesives



Redux® 609

Epoxy film adhesive for large-scale metal to metal and sandwich panel bonding with variable curing rates from 100 to 180°C

Redux® 610

Specially flame retarded version of Redux® 609.

Redux® 206NA / 212NA

Foaming film adhesives for honeycomb core splicing, edge bonding and gap filling.

Redux® 112

Primers for surface pre-treatment protection use prior to use with film adhesives.

Why use Composites in Trains, Trams and Metros ?

- **Rapid construction**

Lightweight, modular interiors are easy to handle and install, providing man-hour savings.

- **High stiffness and strength**

Composites are durable, providing excellent fatigue, impact and environmental resistance. The non-corrosive materials reduce maintenance costs. Structural composites require little (if any) supporting framework, and carry fittings readily. Passenger room increases, while internal noise reduces.

- **Weight savings**

Weight savings enable higher speeds to be attained, reduce power consumption and acceleration inertia. Low weight materials enable existing tracks to be used for new high speed and tilting trains. Smaller ancillary items (suspension, frame, door actuators, etc.) can be used. An increased payload can be carried. The designer can achieve a lower centre of gravity, providing greater stability

- **Passenger comfort**

Trains designed in composites are spacious and aesthetically pleasing. Weight placement optimisation enables passengers to travel in greater comfort.

- **Cost**

Lightweight sandwich panels are quick to install resulting in man-hour savings. Prepreg materials are processed more rapidly than 'wet' systems, with less waste. Lighter trains require less power, and faster trains provide operational efficiencies. The multiple benefits of using composites add up to a cost-effective solution.

- **Design flexibility**

The previously inconceivable becomes reality. Trains are designed for maximum performance, with optimum centre of gravity. Exteriors adopt aerodynamic profiles and interiors are designed with smooth, aesthetic contours, enhancing passenger comfort.

- **Safety**

Enhanced safety features include the incorporation of fire resistant materials, the adoption of energy absorbing honeycombs and prepregs, and the elimination of sharp, jagged edges in a crash situation.



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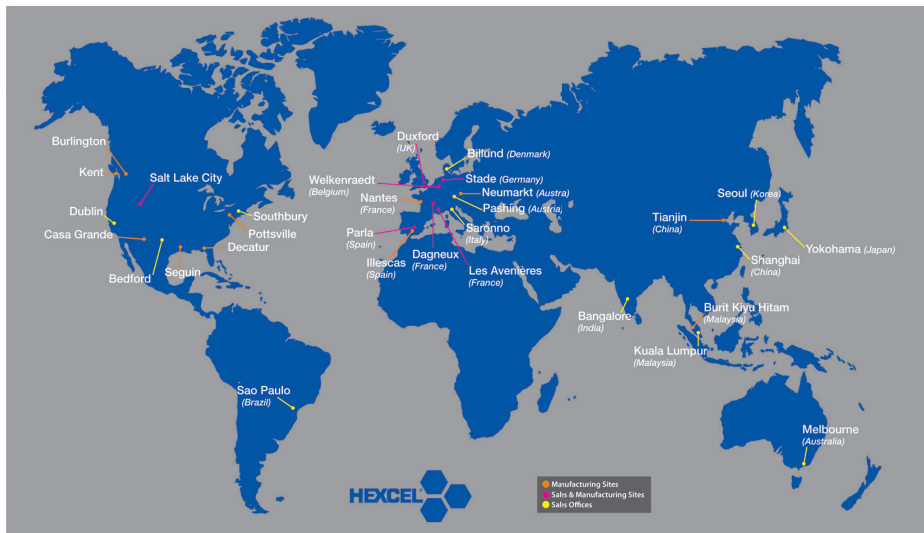
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