



Continuous thermoplastic honeycomb sandwich panel process technology for cost optimal lightweight composites

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Composite materials based on thermosets have for many years enjoyed sizable shares in many markets and applications due to high performance at low weight. In recent years, thermoplastic composites are gaining in popularity due to some inherent advantages of thermoplastics (thermoformability, recyclability, impact resistance, etc.) and process innovations that deliver on cost efficiency.

For applications and parts that involve sandwich panels, EconCore is enabling the cost efficient production of thermoplastic composites combining lightweight thermoplastic honeycomb cores with thermoplastic composite skins of various compositions. Compared to thermoset composites, thermoplastic composite sandwich panels made using EconCore's high-speed continuous ThermHex process enjoy short-cycle times and enable the potential to deliver cost saving and enhanced performance.

The successful innovation has not been achieved in solitude, but rather in collaboration with leading composite and composite part manufacturers. Together with Lanxess, Toray, and others, EconCore is working to deliver on the challenge of cost competitiveness, by combining leading edge materials with high-speed continuous processing that enables conversion of all constituents to final composite sandwich part in one production line.

Breakthrough process technology for sandwich panels

A key breakthrough to enable cost efficient production of thermoplastic composite sandwich panels is EconCore's patented ThermHex technology. The technology is a continuous process for production of thermoplastic honeycomb core (Fig. 1). Thermoplastic resin extruded *in situ* or pre-extruded film is vacuum-formed into a half-hexagonal web and folded into a honeycomb core. The continuous vacuum-forming and core conversion steps occur in series in line at high speed delivering a winning cost position. Integration of continuous skin lamination steps and additional finishing steps as needed further enhance the cost efficiency. For

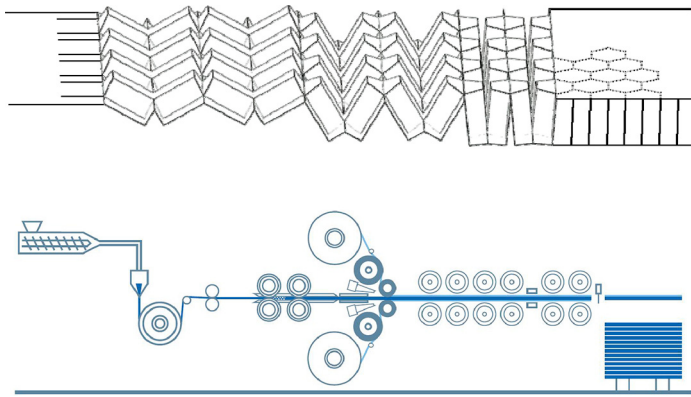
thermoplastic composite skins, where matrix material is compatible with the thermoplastic core, the bonding of skin to core can be achieved by thermoplastic welding, eliminating need for additional adhesive layer. For hybrid skin and core material combinations such as steel and thermoplastic, addition of adhesive layer is straight forward and state of the art. With end of line speed of 10 m/min, the process truly enables competitive cost advantage for users of the technology.

Several companies around the world license EconCore ThermHex technology producing sandwich panels in various material compositions. With applications ranging from packaging, signage, automotive, transportation, building and construction, EconCore licensees share the common requirement of cost efficiency and high level of innovation, both of which are addressed with the continuous production of honeycomb sandwich parts.

Polypropylene honeycomb cores for high performance at minimal weight

ThermHex Waben GmbH, located in Halle/Salle, Germany, has emerged as a new leader of the sandwich core market after installation of EconCore's ThermHex technology to produce PP honeycomb cores (Fig. 2) just in 2010. The core is distributed to the rather fragmented composite market where converters laminate thermoset resins and glass fibers as skin layers producing parts such as truck boxes, trailer walls and roofs, decks and walls in yachts, swimming pools and many others. The appreciation of the high performance-to-weight ratio of such a solution is evident while those processors who did not use thermoplastic honeycombs made by conventional technologies due to economic reasons turn back now seeing that the economy of ThermHex honeycomb is favorable, not only compared

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**FIGURE 1**

EconCore's ThermHex process of continuous production of honeycomb sandwich material.

to the PP honeycombs made by older, conventional processes, but also to foam and other weaker core solutions.

Door now open for composite applications in many sectors

Transportation: trailer walls and aerodynamic elements

Over the years the transportation industry has built capacity of high-speed production of relatively heavy products. The drive toward cost and weight reduction, every present, but increasing as time moves forward, means that key players in the sector are looking for innovations that achieve the goals of lightweight solutions at competitive cost.

Thermoplastic composite (organic-sheet) faced honeycomb panels make a lot of sense in this sector in terms of lightweight performance. For trailers, a 10% reduction in weight can correspond to a 6–8% improvement in fuel efficiency. Today, with the technology to continuously produce such panels available, the equation to deliver these panels as competitive production costs may be solved. The long fiber reinforced thermoplastic composite skins provide good impact resistance, while the low density (lightweight) thermoplastic honeycomb core delivers excellent stabilization. The process technology delivers capacity at competitive production cost. The still air present in the small honeycomb cells reduces convection and contributes to good thermal insulation. The continuous process, capable of larger widths as well, enables possibility for producers to make single piece composite trailer panels corresponding to dimensions of typical trailer walls around 45 feet in length and 10 feet in width.

**FIGURE 3**

'Lightweight honeycomb design of truck and trailers offers enhanced fuel economy and contributes to thermal insulation.'

Considering the need for fleet managers to maximize fuel efficiency, solutions to improve aerodynamics are on the rise. An elegant extension of the product range for those producing thermoplastic composite honeycomb sandwich panels is to add lightweight aerodynamic elements such as air flow deflectors along the sides and foldable rear-end spoilers, to the mix. The versatility of the ThermHex process means that such elements, compositionally similar to trailer walls, but thinner and lighter, can be produced in the same production line. One line for the trailer walls and aerodynamic elements: lightweight, strong, at competitive production cost (Fig. 3). That enables a fast return of investments.

Pick-up truck boxes

Taking advantage of the high rigidity to weight ratio of thermoplastic sandwich materials along with high impact resistance of thermoplastic composite skins, applications such as pick-up truck boxes are being explored (Fig. 4). The thermoformability enables design freedom and is appreciated by part designers.

Steel thermoplastic hybrids

Utilizing an optimal hybrid material combination, one of the most recent innovations using ThermHex technology is a steel skinned thermoplastic honeycomb sandwich material. Tata Steel group, one of the largest steel producers in the world introduced Coretinium[®] at the industry trade show BlechExpo in Stuttgart, Germany in

**FIGURE 2**

ThermHex Waben's PP honeycomb core in a wide range of thickness and large length.

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