

Composite Sandwich Structure Design Requirements



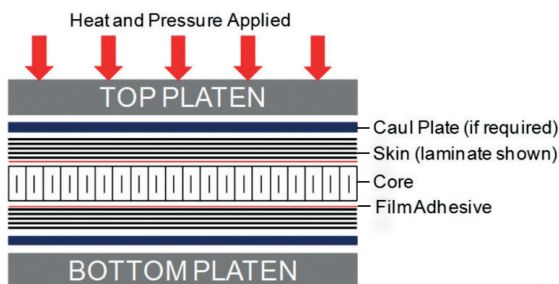
Composite Engineer's Viewpoint

By Rik Heslehurst PhD, MEng, BEng (Aero) FIEAust, FRAeS, CPEng

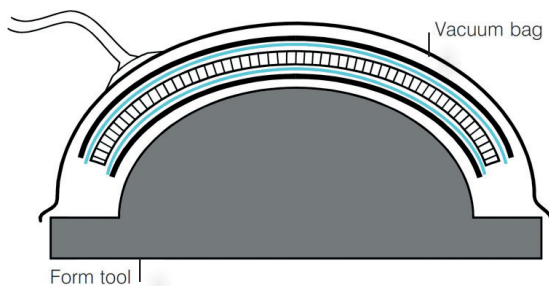
Part 4 – Manufacturing processes

The manufacture of a composite skinned sandwich panel is relatively straightforward. Two lots of resins need to be cured. The resin of the composite skin and the adhesive bonding of the skin to the core must be cured. Thus resin systems used for both parts must be thermally compatible for the curing process in most cases; however, prior to the curing process the core needs to be shaped. Composite skinned sandwich structures require a slightly different approach when manufactured.

Typically the overall panel manufacture is either as a pre-cured skin secondarily bonded to the core (two-step manufacturing process), or a co-cure of the skins with the adhesive bonding to the core (one-step manufacturing process). Curing will typically be done with heat and pressure via a press, or vacuum-bagged (with oven-provided heat or without heat).



Heated Press Construction

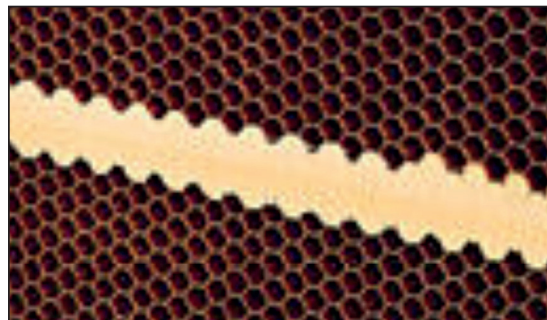


Vacuum-Bagging Process Construction
(Graphic courtesy of Hexcel)

- Core flexibility to contour slightly curved to compound curved shapes
- Core machining requirements
- Skin-to-core cure pressure limitations
- Core exposed side pressure limitation
- Tooling selection and set-up
- Potting of edges
- Inserts, bushings and hard-points

The curing of the adhesive should follow standard practices that are typically recommended by the adhesive vendor. The recommendation will include a heat-up rate; cure temperature and duration; plus a cool-down rate, if using a heat-cured resin system, otherwise there will be a gel and green cure duration for room temperature cured resins.

Often cores have to be joined together (spliced). For foam or balsa cores this is done with an adhesive that partially diffuses into the core materials. For honeycomb core a splicing adhesive is used.



Splicing of Honeycomb core with Potting Compound

The aspects to be considered that effect the approach to the manufacture of sandwich panels, based on the core type used, include:

- Adhesive selection
- Adhesive bond effectiveness
- Adhesive depth of penetration into the core
- Adhesive cure requirements
- Adhesive application
- Core surface preparation requirements

All core materials can be machined to obtain the specific shape. Milling of the core is most common in large production facilities, but shaping with a rasp is often used in small workshops. Some foam cores can be cut with hot wires or a sharp knife.

In the next issue of *Connection* we will discuss composite skin and core materials in terms of their importance as well as the properties that are required when undertaking design stress analysis. All articles published in the Engineer's Viewpoint series are available online at www.compositesaustralia.com.au/industry. Rik welcomes questions, comments and your point of view by email to rik@abaris.com.