QWIK GUIDE:

Balsa Wood versus Polyisocyanurate in Composite Applications

BACKGROUND:

Core materials (sometimes referred to as *substrates*) are used extensively throughout the composites industry to fabricate lightweight composite (often, *sandwich construction*) products with better resultant physical properties (e.g. *stiffness*) than could be otherwise achieved. For example, a core sandwiched with face and back-skin laminates achieved an increase in strength(s) and stiffness by a magnitude of 3.5 times and 7 times respectively with only a 3% weight increase. Other properties such as thermal conductivity (inverse of thermal resistance or R-value) and fire resistance can also be improved by use of optimal core materials. Elasticity of the final product may also be important in certain applications, and the core material is often the deciding factor. While sandwich-construction is a traditional option, advanced composite technologies and approaches, with new innovative substrates, enable opportunities to create composite structures with physical properties far superior to traditional options

END-GRAIN BALSA

Figure 1: Baltek Structural Balsa Core

End-grain balsa wood is a natural cellular material with excellent stiffness- and strength-to-weight ratios. The "end-grain" portion of a balsa timber is cut into small blocks and glued together to create a sheet. Balsa cells are quite oblong; the result is that the various strengths and other properties may vary across the x, y, and z dimensions. With densities of end-grain balsa generally between 6 and 18 pounds per cubic foot (96-288 kg/m^3) [3-5x that of polyiso] this material is quite heavy compared to many composite core alternatives; and expensive.

POLYISO

Polyiso foam is a rigid, closed cell foam material with excellent thermal insulation with water/moisture resistant properties. The cells are very small with quite uniform dimensions, resulting in physical properties (e.g. strength) quite comparable as measured along any axis. Polyisocyanurate is suitable for service temperatures ranging from deep cryogenic up to 350°F (177°C) continuous and 375°F (190°C) intermittent - - such as during the lamination process.

SUMMARY

End-grained balsa indeed has a proven track record, yet balsa is relatively expensive; and high-volume, flexible dimension/shapes, or quick turnaround on delivery may be problematic. On the other hand, polyisocyanurate is quite the opposite!

• lightweight (3-5x less than balsa)	• shorter lead times
• better R-value	• high dimensional tolerance across temperature
• improved flame/smoke resistance	• wider ranges of dimensions with high precision
• higher volume production	• exceptional responsiveness - - all at a lower cost.

Composite technologies are advancing quickly! In some advanced composites, "skins" have evolved into more complex substrates with an integral contribution to the ultimate stiffness of the composite itself. Dyplast is working with multiple clients with such proprietary composite technologies that utilize lightweight/thermally efficient polyisocyanurate as the composite core, yet achieving extraordinary strengths and stiffness specifically in the design of the accessory substrate materials.

View a more comprehensive Technical Bulletin at https://www.dyplastcomposites.com/technical-bulletins-isoc1.