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APOGEE

PEAK OF FLIGHT

NEWSLETTER

Characteristics of Balsa Wood

By Tim Van Milligan

This issue's article comes as a excerpt from the book: *"Model Rocket Design & Construction"* (http://www.apogeerockets.com/design_book.asp). I got the idea to run this excerpt when I received a visitor at our shop last week. He had just gotten involved in rocketry, and didn't know the exceptional qualities of balsa wood. He was shocked to learn that something that was as light as balsa wood could easily withstand a flight at supersonic speeds.

So here is a little bit of information you may not have known about balsa wood:

Balsa wood is the "miracle material" of the hobby world. It has the best strength-to-weight ratio of any other readily available material. Not only is it known for its high strength and low density, it can be easily shaped, sanded, glued, and painted. It is also non-toxic, biodegradable, and absorbs shocks and vibrations well. Balsa wood is imported into North America from plantations in South America; don't worry about destroying the rain forests by using this wood - it grows incredibly fast; an average of 60 to 90 feet tall in 6 to 10 years, with a diameter of about 45 inches. The rain forests aren't being destroyed to harvest balsa wood. Use it with a clear conscience.

Because of its versatility and strength, balsa wood can be used extensively to construct your rockets. Typical uses include nose cones, wings, fuselages and fins.

Balsa can be purchased in most any hobby shop, and it comes in strips, sheets, planks and blocks. Strips sizes can range from 0.79 mm (1/32 inch) X 0.79 mm (1/32 inch) to 2.5 cm X 2.5 cm (1 inch X 1 inch); sheets are available in thickness up to 6.35 mm (1/4 inch), and widths typically 7.6 cm (3 inch) or 10.1 cm (4 inch). Anything larger would be considered a plank or a block of balsa.

You can use strips for making surface details and general reinforcing of the model such as making fin fillets, or for reinforcing the leading edges of glider wings. Use sheet balsa for making fins and wings. And use large blocks for making nose cones, transition sections, nose blocks, or anything that is carved or shaped.

Typically, balsa is identified in two ways. The first is by the density of the wood. The denser the wood, the stronger and harder it is. Densities cans range from 5 to 20 pounds per cubic foot (80 to 320 kg/m^3), with 10 to 12 lb/ft^3 (160 to 192 kg/m^3) considered being medium weight. Extremely lightweight balsa with a density under 6 pounds per cubic foot (96.1 kg/m^3) is considered "contest grade" and is used on competition models where mass must be kept to a minimum and where durability is not a top priority.

The second way to classify balsa is by its grain pattern, which is determined by how it was cut from the log of the tree. Grain direction determines the rigidity or flexibility of a balsa sheet more than density does. For example, if the sheet is cut from the log so that the tree's annular rings run across the thickness of the sheet (called "A-grain"), the sheet will be fairly flexible edge to edge. If, on the other hand, it is cut with the annular rings running through the thickness of the sheet (C-grain), quarter grain, it will be very rigid edge to edge. When grain direction is less clearly defined (B-grain), the sheet will have properties intermediate between A and C grain. B-grain is the most common and is suitable for most jobs.

Whenever you come across pure A-grain or C-grain sheets, learn where to use them to take best advantage of their special characteristics:

A-GRAIN sheet balsa has long fibers that show up as long grain lines. It is very flexible across the sheet and bends around curves easily. It also warps easily and is sometimes called "tangent cut".

DO: Use for sheet covering rounded fuselages and wing leading edges. Planking fuselages, forming tubes, strong flexible spars, hand-launched glider fuselages. Fins for small, ultra-light competition model rockets.

DON'T: Use for sheet balsa wings or tail surfaces, flat fuselage sides, ribs, or formers.

To make A-grain balsa wood more pliable and easier to

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bend without breaking, soak it overnight in a bucket of water with a small amount of ammonia (or bleach) added. It should be bent or shaped while wet, and then held in the correct shape until it is completely dry.

B-GRAIN sheet has some of the qualities of both A and type C. Grain lines are shorter than type A, and it feels stiffer across the sheet. It is general purpose sheet and can be used for many jobs. It is sometimes called "random cut".

DO: Use for the flat sheet fins on most rockets; for flat fuselage sides, trailing edges, wing ribs, formers, planing gradula curves, wind leading edge sheeting.

DON'T: Use where type A or type C will do a significantly better job.

C-GRAIN sheet balsa has a beautiful mottled appearance. Some people say it looks like fish scales. it is very stiff across the sheet and if bent it splits easily. When used properly it helps build the lightest, strongest models. This is the most warp-resistant type, but it is difficult to sand. It is sometimes called "quarter grain".

DO: Use for sheet balsa fins on larger model rockets. Can also be used for sheet balsa wings on larger gliders, tail surfaces, flat fuselage sides, wing ribs, formers, tailing edges. Best type for wings on larger boost gliders and hand-launched gliders.

DON'T: Use for curved planking, rounded fuselages, rounded tubes, hand-launched glider fuselages, or wing spars.

About the Author:

Tim Van Milligan is the owner of Apogee Components (http://www.apogeerockets.com) and the curator of the rocketry education web site: http://www.apogeerockets.com/education. He is also the author of the books: "*Model Rocket Design and Construction," "69 Simple Science Fair Projects with Model Rockets: Aeronautics"* and publisher of the FREE e-zine newsletter about model rockets. You can subscribe to the e-zine at the Apogee Components web site, or sending an email to: ezine@apogeerockets.com with "SUBSCRIBE" as the subject line of the message.

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