

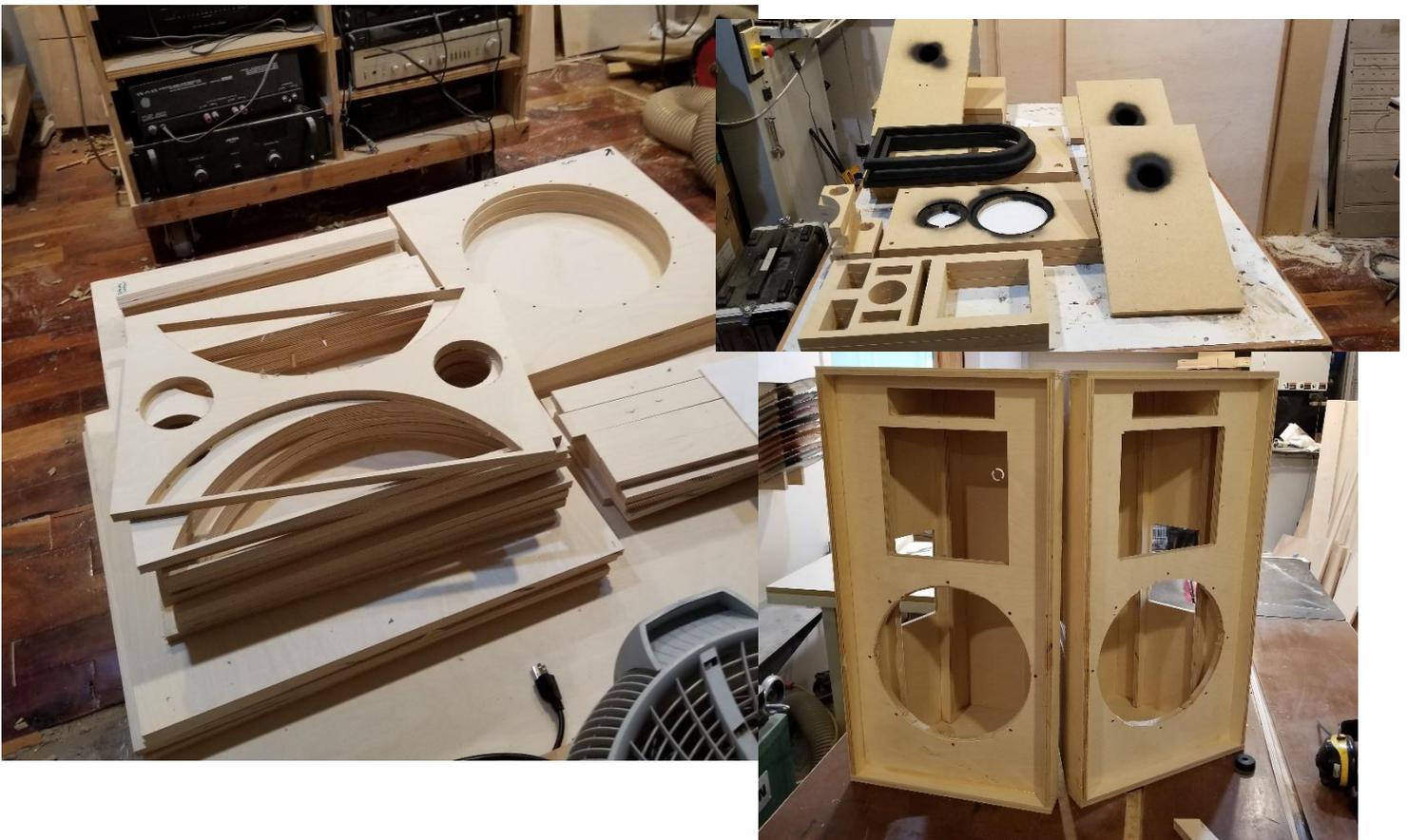
Sheet Good Materials for Loudspeaker Construction

Or

“Hold my beer...imma ruffle some feathers.”

By

Scott Hinson



Introduction

One of the things that drives me bonkers in the audio forums is blanket “my way or the highway” type statements said with absolute certainty without any actual factual backup...or even being correct. Luckily it doesn’t happen often¹.

What wood should I use?

As a DIYer we don’t have all *that* many choices at our disposal. The vast majority of DIY loudspeakers are made with a small handful of materials, the top choices being MDF and plywood of some type. As 3D printing is becoming more common you’re starting to see more plastic 3D printed enclosures, and some truly courageous folks have done cast epoxy, fiberglass, concrete or other advanced constructions. You’re savages, mad props and we can definitely be friends.

But is there a right choice? Is there a best choice? Maybe we should come back and put a bit of subtlety and context around the decision. There are pro’s and cons to every material selection and construction. In some specialized cases there’s only one material to use but the vast majority of DIY constructions can use...gasp....just about any of them.

As a DIYer we don’t have access to the advanced FEM tools of the big companies, nor the advanced injection molding, machining and in some cases RF/Microwave adhesive curing techniques. The vast majority of DIY’ers (and small manufacturers) build our speakers by cutting up sheet goods and gluing them together. We aren’t going to be using a laser vibrometer to measure deflection...we just can’t afford it.

But we do have something that the big companies don’t have....time. In a world where, depending on the price level of the speaker...the time for assembly is shockingly short, compromises must be made for cost reasons. DIYers can add all the shelf bracing we desire. Where the corporate accounts are pushing for a price point that effectively requires a v-fold assembly with high speed cure adhesives...we can build much more intricate enclosures with substantial bracing.

At the end of the day MDF, Baltic Birch, “big box” home improvement store cabinet plywood...heck even CDX can be used if you’re willing to put in the effort. So lets go into the common materials for some pros and cons. But the entire time...keep the big picture in mind...literally any of these materials can be used quite successfully. ***There is no magic material, and our construction methods/design will contribute more substantially to our success in building an inert high quality speaker cabinet than the sheet good material.***

¹ My sarcasm meter just burst into flames. I think that’s bad.



MDF

MDF has been the gold standard for quite some time. It's relatively inexpensive, uniform, dimensionally consistent and has pretty good acoustical properties. For loudspeakers it's internal damping is pretty good. It glues well with both PVA and polyurethane sticky maple syrup death glue (love that stuff).

It does have drawbacks. The dust is horrendous...since it's made by compressing wood fibers once those are cut there's a bazillllion little dust particles floating in the air. Proper masking and air filtration are a must...even if working outside, masking up is a great idea.

It's horrible at avoiding damage from banging hard objects into corners...the material crushes away quite easily. If it gets wet it swells and the internal glue bonds are broken forever. This is actually a problem even in veneered or painted speakers. The glue lines over time can swell and these joints will telegraph through the veneer or paint. It's especially bad if you use water based paints as they will provide all the moisture necessary to get the process started. Ask me how I know.

You need to use carbide tools for routing/table saws etc. The higher speed of the cutting edges and the material mean there's quite a bit of heat buildup and it dulls high speed steel (HSS) bits/blades quickly. HSS drill bits are fine.

Putting screws into the face of the material is great, easy to do, split resistant and quite strong. If you're putting a screw into the edge, use pilot hole and be prepared for a weak hold, if it's a screw that's going to come out again, don't expect it to re-thread with anywhere near the same holding strength.

Baltic Birch

Baltic Birch is the gold standard for PA speakers...but should be looked at for lots of other speakers too if it's in the budget. Not quite the same internal damping as MDF so you'll need to pay more attention to the bracing. You can end up with a pretty lively enclosure if you build a bookshelf sized speaker without a brace both vertically and horizontally, where you might get away with just one direction using MDF. It is much tougher to damage from getting hit with other objects...I've banged into PA speakers pretty good with hammers, other speakers, my head², and cars³...and many times there is no damage or minimal damage...to the speakers. If

² Don't ask.

³ Well..what happened was...never mind. Don't ask.



you're going to build a PA speaker...you REALLY should use this. If you're going to build a speaker that's going to be flown overhead...you REALLY REALLY should use this. I'm not going to teach you how to do it⁴, but know...if you are...and you use something else you're probably not doing it right.

Baltic Birch has significantly higher strength in tension, and can take screws in both the face and edge with strong results. You can even expect to be able to re-thread a screw in Baltic Birch a couple of times without losing strength in the hold, if you're careful/gentle about restarting the screw by hand.

Dust isn't as big of an issue...but saw dust of all forms is generally considered toxic and should be avoided.

Big Box Store "Cabinet Grade" or "Void Free"⁵ Plywood.

This stuff is perfectly useable. But you're not going to have as easy of a time as either MDF or Baltic Birch. For as often as the signs in the store will say that it's void free or cabinet grade it's usually not the first...and only nominally the later.

Compared to Baltic Birch it's not as strong for screws into the edge, nor is it as resistant to damage, from cars or other things. It often has voids and the face veneer is paper thin. Don't expect to do much sanding without seeing the layers below. Before committing a piece to your project by gluing it in...gently rub your fingers over the surface of the veneer on both sides...if you hear a change in the sound that's likely a loose veneer piece or a void in the first layer. You might want to cut another piece. If you find a void in an edge, and you have to use it...sometimes you can fill them with another piece of wood trimmed to that thickness or the two part epoxy based wood fillers. Either one can be made into a patch that's just as strong as the original wood.

The acoustic properties are such that you probably ought to brace a bit more than Baltic Birch ply... and definitely more than MDF.

CDX

CDX is a grade of construction plywood that I would reserve for use in test cabinets or things that will get lots of textured paint/carpet. For working with it...pretty much copy my comments on the cabinet grade box store plywood in the previous section. The one thing to watch out for is that it tends to warp more easily, come with a bit of warp/bow in it which can make precision difficult. I've built more than a few boxes out of it, it's cheap, heavy and it works.

⁴ Seriously...don't ask.

⁵ The lie detector is on fire now...what's goin' on!!!



OSB

Oriented Strand Board, or OSB is another inexpensive material. This one I just tend to avoid. It's not great to work with...doesn't hold screws well in either the face or the edge, because of the grain orientation glue joints are weak. I've seen it used with thermoset adhesives in commercial enclosures..but they were super cheap. I've also seen it used with construction adhesives...they type that comes out of a caulking gun. It's doable...but annoying.

Hardwood

This one always seems controversial. I live in an area with about 3-4% seasonal moisture content change over the course of a year. That means if I did a flat sawn cherry baffle 10" wide over the course of a year it could expand $3/32$ ". Considering that could easily take up the clearance of a driver mounting hole with a #6 machine screw in it...I'm not sure I'd risk it.

Of course there's very famous commercial speaker systems made substantially out of hardwoods, but if you study the construction pictures online you often see things that help. Baffles glued in with an elastomer allowing for a degree of freedom, kerf cuts in larger panels to allow for stress/strain to be taken up in the panel instead of being transferred to the joint.

You can also slow moisture exchange down by finish choice...shellac is rather porous to moisture while polyurethane finishes have a much slower moisture vapor transmission rate. Coating the inside and outside of the enclosure also helps establish equilibrium. You can also try laminating the hardwood to a substrate. In tables this is a big no-no because they will invariable bow from the differences in expansion...but over the smaller dimensions of a speaker it seems to work pretty well.

All this to say...while it can be done, I don't because in my area if I build something it's a ticking time bomb for checks/cracks and air leaks.

Conclusion

There you have it. I've written a paper without a math formula. I feel weird about it. Like I need to make one with formulas, lots of them...just to make up for it.