The Paper Project Cookbook for

Papermaking at Home and in the Classroom

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The Paper Project Cookbook for

Making Paper in the Home and Classroom

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Version 1.0

Introduction

There are many useful books available to give the teacher or home paper maker assistance in creating handmade paper (see the bibliography at the end of this section). What we present here is, we think, an easy-to-follow variation. If you read about other versions, or you can think of a better way to do one step in the process, give it a try. Experiment. Be creative. If one thing doesn't work, try something else. There is no absolutely one way to do all of this.

Definition of Paper

It helps to know what is considered paper when beginning the process of papermaking. For that reason we offer this definition by Dard Hunter.

> "To be classed as true paper the thin sheets must be made from fibre that has been macerated until each individual filament is a separate unit; the fibres intermixed with water, and by the use of a sieve-like screen, the fibres lifted from the water in the form of a thin stratum, the water draining through the small openings of the screen, leaving a sheet of matted fibre upon the screen's surface. This thin layer of intertwined fibre is paper."
>
> (Hunter, Papermaking, p.5)

It is the process of maceration that separates the individual fibers that will then be processed into the sheets of paper that we see and use every day. It is unlike other surfaces that might be mistaken for paper, such as papyrus, which is made using an entirely different method.

Papyrus isn't paper

Strange as it may seem, papyrus is not paper. Even though the word "paper" comes from the word "papyrus" they are not the same material. Again we offer a definition from Dard Hunter.

> "Papyrus is a laminated substance made by cutting or slicing the stalks of the plant from end to end with a stone or metal knife and pasting the thin delicate "boards" together, in much the same way as a carpenter or cabinet maker builds up sheets of laminated wood."
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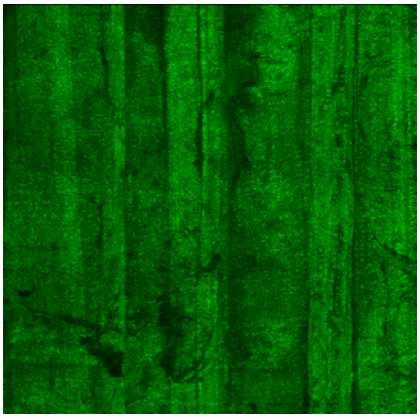
> (Hunter, ibid., p. 6.)

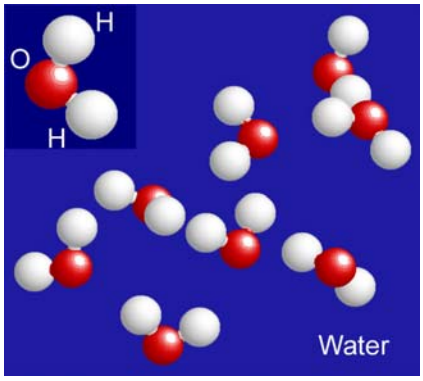


Scanning confocal microscopic image of papyrus

As you can see from the image to the right, papyrus does resemble a very carefully laminated surface. So papyrus and paper are made in different ways. This is also true of other materials that have are used as writing surfaces. Vellum and parchment are made from animal skin. Tapas, a material of the South Pacific islands is also made without macerating fibers into their individual units.

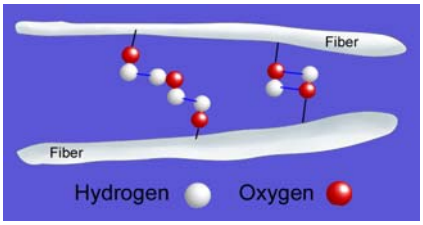
Where's the glue?

Another common misunderstanding of paper is how it is held together. Where's the glue? Is a question that pops up when novices to papermaking first experience the process. The answer is there is no glue. At least there is no glue as one might think of glue. Instead, paper is held together with hydrogen bonds. These bonds combined with the tightly entwined fibers holds paper together.



Familiar water molecules H_2O

You might remember hydrogen bonds from your chemistry class. If not, let's just take a quick look at one. In the figure upper right is a diagram of water. In the upper left corner of the diagram is a single water molecule consisting of the familiar two 2 hydrogen molecules and one oxygen molecule (H_2O). As far as chemical bonds are concerned, hydrogen bonds are weak. However, paper has millions if not billions of hydrogen bonds that help to keep the individual fibers held tightly together.



Paper fibers held together with hydrogen bonds.

Bottom right is a simple diagram of paper fibers and the hydrogen bonds holding them together.

Making paper

Equipment and Supplies

The technique used in this cookbook makes use of common materials and requires at most a little woodworking to create beautiful handmade paper.

Materials

- Scrap paper from junk mail, catalogs, or magazines, torn into small pieces (you'll need about one large sheet of scrap for each sheet of paper you're going to make). Avoid using newsprint; when it's beaten it turns into a gray mush and produces an unattractive sheet of low-quality paper that has already been recycled. Also newsprint isn't acid-free, so paper made from it yellows and gets brittle.
- A food blender (often available in thrift stores).
- A mold (a frame to which a fine mesh screen has been attached).
- A deckle (a frame that mates with the one used for the mold, but which has no screen).
- A vat (a large plastic container that holds the slurry picked up by the mold and deckle).
- Liquid starch (optional, for sizing).
- Kitchen whisk
- Pieces of wool blanket, about twenty, each cut a bit larger than the sheet size.
- Spray bottle (to hold water for misting the surfaces of the wool blankets).
- A large sponge
- Two plastic or waterproofed plywood boards (for pressing formed sheets).
- Pieces of cloth (bed sheeting works well) cut to size for ironing the formed sheets dry.
- An iron.

The Process

Step 1 Tear or cut the scrap paper into small pieces.

Step 2 Soak the pieces of scrap paper in a bowl or pail for at least half an hour, but preferably over night. The sizing on the scrap paper may make the water milky; you can leave it or refresh the water if you wish.

Step 3 Put the scrap paper (about one part paper to five parts water) into the blender and secure the lid tightly. Then blend the mixture in short bursts. Turn off the machine from time to time and check to make sure the pulp is not collecting around the blade.

Step 4 When the consistency of the fibers in the water is even, with no obvious lumps, place a small bit of pulp in a jar of water. Put on the lid and shake the jar; then hold the jar up to the light. If there are clumps of fiber, blend the mixture further and then test again until there are no lumps in the test jar.

Step 5 Dump the beaten paper fibers from the blender into a pail or large bowl and repeat Step 3 until you have the amount of pulp you need for your project. (We added a sheet of cranberry-colored paper to the blender to give our paper the color you see in the pictures).

Step 6 Fill the vat half full with water (if you want to add sizing to the water, which will allow you to write on the paper you make, add a couple of tablespoons of liquid starch to the water and stir thoroughly). Now add pulp from your stock supply, until you have enough to create a good sheet (three or four cups of pulp dispersed in the water). The more pulp you add to the water, the thicker the final sheet.

Step 7 Mix the pulp in the vat with your hands or a kitchen whip until it is dispersed evenly (this mixture is called a "slurry").

Step 8 Wet the mold and deckle. Then, holding the deckle on top of the mold (in contact with the screen side), reach toward the back of the vat and, in one continuous motion, pull the mold and deckle under the surface and up again, catching an even layer of pulp on the surface of the mold.

Step 9 As you pull the mold and deckle upward, keep the deckle tight and very gently move the pulp on the surface of the mold left and right and back, then away and toward yourself and back. You are forming the sheet at this step, an action that should last only a few seconds.

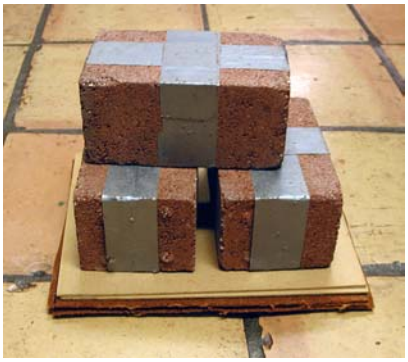
Step 10 Let the water drain from the wet pulp for about fifteen seconds. Then remove the deckle and let the water continue to drain. Meanwhile, with the spray bottle, spray (mist) a light layer of water droplets onto one of the wool blankets.

Step 11 Now transfer the layer of pulp on the mold onto the blanket by rolling it gently across the surface of the blanket (this is called "couching," pronounced KOO-ching).

Step 12 Before lifting the mold off the sheet, use a sponge to absorb water in the newly formed sheet by pushing it against the underside of the mold. Move the sponge around so you contact all the surfaces.

Step 13 Continue to make sheets by repeating Steps 7 through 12, by placing down a blanket, then a sheet of paper, then a blanket, etc., building up a stack of sheets (called a "post"). Finish by putting a blanket on top.

Step 14 After you have make a stack of sheets, place the blankets and sheets of pulp between two hard plastic or plywood boards and remove the water by putting weight on the top. You can use either a mechanical press, place several bricks on top of the pile, or even carefully stand on the pile until the water in the pulp is squeezed into the absorbent blankets and the sheets are flat.



Step 15 You can then unpack the pile of sheets and blankets and, lifting at a corner, carefully lift the formed sheet of paper away from the blanket, placing each sheet on a piece of cloth, and then covering it with another piece of cloth.

Step 17 Iron the sheet of paper between the two pieces of cloth until it is dry.

Step 18 When the sheet appears to be dry, place it in a thick phone book overnight to absorb whatever water might remain in the sheet. This will help cut down on the cockling. The next day, your sheets of paper will be ready to write on, cut into shapes, or whatever your imagination can come up with.

Finished

Making a Mold & Deckle

Equipment and Supplies

Molds and deckles are easy to buy, but they can be expensive. They are also easy to make if you're on a tight budget. An illustration of one method follows. Variations of this mold and deckle can be used to make the process easier and less expensive.

Materials

- Wood (3/4 inch or 1 inch)
- Screws (flathead wood screws)
- L-brackets
- Wood glue
- Marine Spar Varnish
- Duct tape
- Window screen material

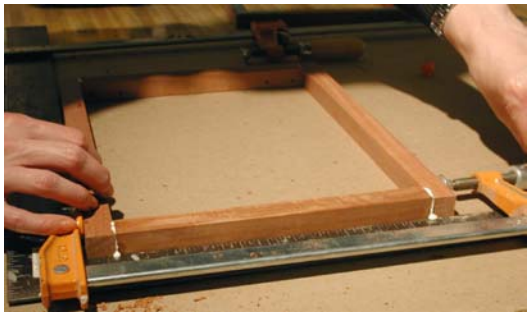
Tools

- Drill
- Brush
- Scissors
- Staple Gun
- Wood clamps (optional)
- Miter saw (optional)
- Framing square (optional)
- Nail set or nail (optional)

The Process

Step 1 Cut eight wood pieces. These will be used to make the two frames. The dimensions will depend on the size of paper you want to make and the size of wood. If you do not have a miter saw, most hardware stores will make these cuts for a nominal fee.

Step 2 Glue the ends of frame pieces together. Apply glue to the ends of both pieces of wood. Use a wood clamp to hold the frame together while the glue dries. If you don't have a wood clamp, you could use heavy phone books or bricks placed tight against ether side of the frame. Use a glue rag to wipe off the excess glue.



Step 3 Place the L-brackets at each corner of the frame and mark the placement of the holes for drilling.

Step 4 Make a small pilot hole for the drill bit using a nail set or a nail. This will insure that the drill holes remain aligned.

Step 5 Drill the holes for the L-brackets. Take care not to drill through the wood frame.

Step 6 Attach the L-brackets using the flathead wood screws. It helps to partially screw in each screw to insure the best alignment of the L-bracket. Then gradually tighten the screws until the bracket is firmly attached to the frame.

Step 7 Cut a piece of the screen material that will be stapled to the side of one of the frames to make the deckle. Leave one to two inches of excess screen beyond the frame. The excess material will be trimmed later.

Step 8 Staple the screen on to the frame side that does not have the L-brackets. Stretch the material as you staple to be sure that it will be tight when finished.

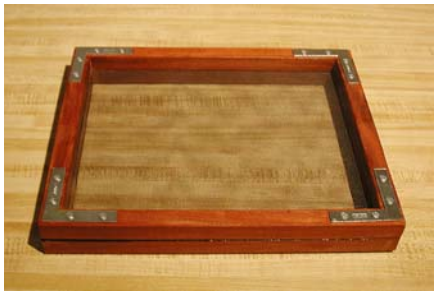
Step 9 When the screen is completely attached to the frame. Trim the excess material using a pair of scissors.

Step 10 Carefully hammer down the staples until they are flush with the wood frame.

Step 11 Apply a strip of duct tape over the staples and screen. Trim the excess to the edge of the frame. Do not wrap the excess tape around the frame, because it will become clogged with paper pulp. The tape is also more likely to ware and fray if wrapped around the wooden frame.

Step 12 Apply two to three coats of marine spar varnish to the frame (allow manufacturer's suggested dry times between coats). Take care not to get any on the open screen area. It will block the holes. If some varnish gets on the screen, dab it with a rag to remove the excess. Marine spar varnish is important because of the time the mold and deckle spend in water.

Finished! The completed mold and deckle are ready to be used.



Variations for Making a Mold and Deckle

Picture Frames can be purchased and used to replace steps 1 and 2. Just be sure to purchase two frames that are the same exact size and shape. The wooden sides need to have a square profile. The rest of the steps remain the same.

Embroidery Hoops can also be used to make a mold and deckle. The screen is held within one set of hoops to make the mold. Another hoop is then used to make the deckle. The shape of the paper becomes an interesting round shape using these molds and deckles.

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