

Patterning Paper by Wax Printing to make Paper-based Fluidic Devices (microPADs)

Wax printing involves two basic steps: printing wax onto a sheet of paper in a desired pattern and heating the paper to melt the wax so that it coats the paper fibers and creates hydrophobic barriers.

Equipment:

1. Solid ink printer: These are sold by Xerox, the least expensive option is currently the [ColorQube 8570](#).
2. Oven: Any oven capable of reaching 200 °C will work. Other heat sources such as a hot plate or iron will also do the trick, but the most uniform and reproducible results can be achieved with an oven. We use an [MTI convection oven](#).
3. Computer and drawing software: We typically work with Clewin and Adobe Illustrator

Supplies:

1. Paper: We typically work with Whatman No. 1 Chromatography Paper, which is conveniently available in 20cm x 20cm sheets.
2. Solid ink for the printer.

Procedure:

1. Design your devices. When designing a device, the hydrophobic barriers need to be at least 200 μm wide for patterning Whatman No. 1 paper (we recommend 300 μm just to be safe and avoid any leaks). Also, your design should account for the fact that the wax will spread out during the heating step. As a rule of thumb, the wax will spread approximately 400 μm in every direction during the heating step, so lines that are designed to be 200-300 μm wide will end up as 1 mm wide barriers in the device. Likewise, when designing a channel, you can add 1 mm to the final desired width to account for the spreading of the wax.
2. Print the pattern on paper. We use the highest resolution print settings.
3. Heat the paper: for Whatman No. 1 paper we set the oven to 195 °C and bake for 2 min.

References:

1. Carrilho, E.; Martinez, A. W.; Whitesides, G. M. "Understanding Wax Printing – A Simple Micropatterning Process for Paper-Based Microfluidics," *Analytical Chemistry*, 2009, 81, 7091-7095.