

Printmaking Labs 1–3

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Overview: Etching –A Chemical Process and Printmaking Technique

The basic principle of etching is very simple, but there are many variations within the technique. To make an etched plate (for print purposes) is to bite lines and textures into a metal plate with one of a variety of **etchants**. In the Etching Lab we will experiment with the **etchants** hydrochloric acid and nitric acid. The **metal plates** used in etching are usually made of copper, zinc, or aluminum. In our Lab we will use zinc plates. From your previous classtime lab on the Activity Series, you observed that copper and zinc could both be oxidized by nitric acid. Zinc can also be oxidized by hydrochloric acid. This should convince you that these acids are useful chemicals for biting lines in a zinc plate. Your zinc plate will be covered with a waxy acid-resisting coating (**ground**). Using an **etching needle**, you will scrape a design into the ground exposing the bare metal so that it can be oxidized by the acid solution (etching bath). Your prepared zinc plate will be submerged into the acid bath until the desired depth or width in the bitten areas is achieved. Not only will you examine which acid makes the better etchant, but you will also consider which concentration of acid and what length of contact time is optimal for etching the zinc plate.

Before coming to lab, write balanced equations for the etching of zinc with nitric acid and hydrochloric acid. Look in your table of half-reactions to find half reactions for the oxidation of zinc and the reduction of nitric acid and the reduction of hydronium ion. Add the appropriate half-reactions together so that one is an oxidation and the other a reduction. Be sure that the electrons cancel when you add the two halves.

After the zinc plate has been etched to the desired depth, it is rinsed with water to stop the etching (oxidation) process. **Mineral spirits** are then used to remove the ground and expose the etched plate. You may remember the solubility rule, “like dissolves like”. This is the principle at work in dissolving the ground from the zinc plate with mineral spirits. Mineral spirits and ground are both non-polar organic materials. To further clean the plate, **isopropyl alcohol** is used. This removes greasy fingerprints from the surface of the zinc plate. This is a further application of “like dissolves like”. The fatty acids from your hands are somewhat polar, as is the isopropyl alcohol. In order to keep the plate clean, hold it by its edges.

Once the plate is clean, you will be ready to prepare the plate for printing. This involves inking the plate and then wiping it. The techniques for these procedures will be demonstrated in lab. After your plate is properly inked and wiped you will use a **press** to make a print. This requires paper to receive the inked image. So questions arise about the use of paper in the printmaking process. What kind of paper works best for printing an etching? Should the paper be made of wood fibers or cotton? How thick should the paper be? Should the paper be soaked in water before the printing? If you have some paper left from your Paper Lab#3, you might experiment with printing an etching on it. Answering all the questions about paper in printmaking would require more lab time. Instead, paper appropriate for printing etchings will be provided, along with instructions on how to tear, soak, and blot the paper to prepare it for printing.

Printmaking Lab: Etching – A Chemical Process and Printmaking Technique

Purpose:

- To learn the procedure for preparing a zinc plate to be etched
- To consider the factors which affect the etching of a zinc plate
- In pairs, to design and execute an experiment to examine one of these factors
- As a class to share experimental results and determine optimal conditions for etching a zinc plate
- To use these optimal conditions to etch the zinc plate that will be used to print an etched bookmark
- To learn how to use the etched zinc plate to produce an etching (inking, wiping, preparing paper, printing).

I. Etching a Zinc Plate (Determining Optimal Conditions)

Procedure: (techniques will be demonstrated). Record all observations in your lab book.

1. Prepare the plates for etching. Refer to Steps for Preparing an Etching, 1 – 9. Follow these steps to prepare your three zinc plates to be etched.
2. Design an experiment to determine what factors affect the success of etching zinc plates. Refer to steps 10 – 14 of Steps for Preparing an Etching. What conditions are optimal for etching the zinc plates? As a class, discuss what factors might affect the etching, e.g., kind of acid. What are some other factors? Working in pairs, each pair will explore one factor. Remember to only vary one factor at a time so you can see its effect. Write out a stepwise procedure in your lab book.
3. Perform your experiment using your two smaller zinc plates. Record the initial appearance of your zinc plates. Then, record observations as your experiment proceeds. How do you decide when to stop?
4. Compare experimental results with your classmates. Which acid should be used to etch the plates? What concentration of acid should be used? How long should the plates be etched? In order to draw conclusions you will need to ink and wipe your etched plates and print an etching (Refer to steps 15 – 18.) The printed image will serve as evidence. Record your observations during the printing/pressing steps and after the print has dried. Draw conclusions from your shared experimental results and record them in your lab book.

II. Printing an Etched Bookmark (Printmaking Labs 2–3)

1. Come to lab with a design for your bookmark. Techniques for transferring your design onto the zinc plate coated with ground will be demonstrated.
2. Follow steps 1 – 18 to create your etched bookmark. You should make an edition of at least three. You may want to vary the color of ink used.

Steps for Preparing an Etching

• Preparing the plate

1. Obtain three pieces of zinc plate (2 smaller, 1 larger)
2. Peel-off plastic coat from plate.
3. Bevel edges of plate with a triangular file.
4. Clean off ZnO coating with putz-pomade (abrasive).
5. Holding plate at edges, clean plate with Isopropyl Alcohol.
6. Lay clean plate on piece of paper toweling in hood.
7. With a brush, apply an even coat of ground onto the clean zinc plate in hood (try to avoid double thickness, but plate must be coated).
8. Allow coated plate to stand in hood until ground is hard (dry).
9. Remove coated plate from hood and using an etching needle selectively remove ground to create your design on the plate.

• Etching the plate

10. At this point there will be a group discussion about experimental options. Immerse plate in etching bath and continue to etch until desired depth of bite is achieved. While the plate is being etched, bubbles of gas will form on the surface of the plate. These bubbles should be brushed away with a small brush at regular intervals. Do not let bubbles collect on the surface of the zinc plate.
11. When the zinc plate is etched (bitten back) to your satisfaction, remove it from the acid bath and rinse it with tap water to stop the chemical reaction. Pat the plate dry with a paper toweling.
12. In the hood, remove the ground from the etched plate using mineral spirits and paper toweling. Be sure the plate is completely clean. Discard waste towels in receptacle in hood. Important. Do this work in the hood.
13. Make a final rinse of the etched plate with Isopropyl Alcohol, holding only onto the edges. Wipe dry with paper toweling.

• Printing the plate

14. With clean hands, prepare a printing press template for your piece of zinc. Teacher will demonstrate. Also tear pieces of paper for printing and put them to soak in a water bath.
15. Ink the plate, using a small piece of cardboard to drag ink across the plate and into the etched grooves. Wipe excess ink from the plate with another piece of cardboard. Discard the inky pieces of cardboard after using. Using a foot square piece of taffeta wipe the surface of the plate clean, leaving ink in the grooves. Teacher will demonstrate.
16. With clean hands, remove soaked paper from water bath and blot so no shiny water spots can be seen on the paper.
17. Prepare a template and place it on the bed of the press. Carefully place the inked zinc plate face up on the template. Place the moist paper on top of the zinc plate using the edges of the template to align the paper properly. Lay down the felts and run the plate and paper through the press. Lift the felts carefully, one at a time and then lift the paper from the metal plate. Set the print on a drying board to dry.
18. Clean the zinc plate and re-ink for another trail or clean and store in a plastic bag with a label for future use.