

INTRODUCTION

Chemical staining is one method available for cement masons to demonstrate the creative effects used in the field of decorative concrete. Cement masons can create impressive artistic effects for a variety of purposes. Staining can turn ordinary concrete slabs into floors that resemble marble or glazed stone. Cement masons are also using staining to create elegant patios, walkways, entrances, and countertops. Stains can be used on most concrete surfaces.

FOCUS ASSIGNMENTS

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1. Find a local establishment that has used stained concrete for decorative purposes. Is the effect appealing? Do you consider the colors agreeable with the surrounding area?
2. If you had been the cement mason who designed the project, would you have chosen a different color effect? If so, what would that be? If not, explain why you consider the stain technique effective. Write a paragraph describing your response to these two questions.



UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Name factors that affect the acid staining process.
2. List the steps for preparing an exterior concrete slab for staining.
3. Recall the steps for applying a chemical stain.
4. Explain the procedures for rinsing and sealing stained concrete.



5. Identify special color effects achieved through acid staining.
6. List safety guidelines for applying chemical stains to concrete.
7. Apply an acid-based chemical stain to a slab. (Job Sheet 1)
8. Apply a chemical stain to a design scored into a concrete slab. (Job Sheet 2)



OBJECTIVE 1

Name factors that affect the acid staining process.

Chemical stains add color to uncolored concrete and change the color of previously colored concrete. Many color effects can be achieved with decorative staining. These stains can be used for a variety of creative purposes. They are now frequently used on floors and walls-- in malls, plazas and walkways-- creating stunning colors, diverse shades and sometimes mimicking the age-worn appearance of former civilizations. The chemical reaction that occurs between the stain and concrete creates a highly durable, abrasive resistant product, superior to acrylic and other paints. Chemical staining, once in place, does not dissipate. It fades only as the concrete itself begins to lose its texture as a result of wear or environmental damage.

Though referred to as acid stain, it isn't acid that colors the concrete. When mixed in an acidic water-based solution, metallic salts react with hydrated lime in the concrete to produce color compounds. The acid in the stain has the effect of opening the concrete surface, allowing the metallic salts to combine with the lime deposits. Certain factors affect the outcome of the staining process:

- Concrete finishing method
- Age of concrete and moisture content when the stain is applied
- Weather conditions when the stain is applied
- Admixtures used
- Properties and amount of cement used
- Sealers, waxes or oil contamination



OBJECTIVE 2

List the steps for preparing an exterior concrete slab for staining.

WORDS YOU SHOULD KNOW

reactants	chemicals that “react” with cured concrete to produce its color effects
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1. Produce test sections.
2. Protect areas surrounding the surface to be stained. Rope off the work area, remove nearby vehicles and do not allow traffic in the area.
3. Before application, insure that no water sources will affect the area such as sprinklers or fountains.
4. Remove all coatings such as paint, waxes, as well as dirt, oil, and grease by cleaning the surface area with a scraper, paint stripper or other appropriate cleaner.



Important: Acid washing should be avoided because it may negatively affect reactants necessary for the staining process to succeed.

5. Consider weather conditions. Hot, dry, and windy weather may cause the stain to dry faster, affecting the desired effects. Rain will flush the stain from the surface and stain surrounding areas.
6. To make it penetrable, open the surface of dense concrete with high-pressure water or a rotary floor machine. (Figure 1)

FIGURE 1



OBJECTIVE 3

Recall the steps for applying a chemical stain.

✓ **NOTE:** Stain only after concrete is cured. A minimum of seven days is required though 28 are recommended.

1. Insure that all surfaces are dry.
2. Divide the work area into small sections using walls or joint lines.
3. Follow safety procedures: wear protective gear and follow all government regulations and manufacturer's instructions. (Figure 2)

✓ **NOTE:** Chemical stains must comply with air quality management regulations.

FIGURE 2



4. Use an acid-resistant, plastic container for the solution. Do not use metal containers for chemical stain solutions.

✓ **NOTE:** Use only all plastic manufactured hand pump sprayers. Metal parts of sprayer will react to acidic stain.



5. Apply the stain with a hand pump sprayer, mop or a brush. (Figure 3)

FIGURE 3



6. Immediately after applying the stain solution on the surface, scrub with a long-handled or hand-held, acid-resistant brush. Use a colorless brush with medium or stiff bristles.
7. When removing the solution from the container, be careful to avoid splashing.
8. A cement mason should spray the solution onto the surface followed by a second cement mason who scrubs it into the surface. (Figure 4)

FIGURE 4



9. The solution should be scrubbed into the surface with a circular or figure eight motion. (Figure 5)

FIGURE 5



10. Brush the surface continuously, spreading the solution until uniform.
11. If applying the stain vertically, work from the bottom of the concrete area upwards.
12. If applying different colors, wash the surface between applications to determine the color effect before adding other colors.

✓ **NOTE:** Chemical stains are highly corrosive. After handling, wash yourself thoroughly. In addition, close the container and store upright away from combustible agents and heat sources. To dispose of the chemical, check with local waste management in your area.



3. Perform a pH test using litmus paper or pH paper to determine whether acid is still present on the surface.

✓ **NOTE:** Certain sealers are affected by the pH of the surface of the slab. pH level should be between 7 and 8. Check manufacturer's recommendations. (Figure 7)

FIGURE 7



4. If the pH still exceeds the recommendations the sealer you are using, neutralize with a solution of baking soda and water.
5. After these procedures, wipe the surface with a white cloth to determine whether the area is clean. If residue exists, clean the area until the cloth is clean. (Figure 8)

FIGURE 8



6. Observe the area and make sure that there is no spillage or runoff that could create environmental dangers.
7. After rinsing, allow the slab to dry before sealing.

✓ **NOTE:** If the surface is not properly cleaned and stain residue removed, the sealer will not work effectively.

OBJECTIVE 5

Identify special color effects achieved through acid staining.

Cement masons have developed a variety of techniques to create diverse, unique designs with acid stains. Special effects can be achieved by experimenting with colors to create different shades, though it is recommended to create test sections before using these techniques. Some of the methods of creating varied color effects are as follows:

✓ **NOTE:** Test areas are strongly recommended on the job site and the particular surface to be stained. This recommendation is due to the diverse conditions that affect the outcome of the staining process, such as the porosity, age, texture and color of the concrete being stained.

- Two or more colors may be mixed together before application.
- One color may be applied while the concrete is wet.
- Adjacent sections may be stained with different colors.
- A sequence of colors may be applied with different colors.
- Applying color sealers to the stained surface can alter colors.
- Applying the stain over concrete previously colored with concrete hardeners can create different color effects.
- Sprinkling an iron soil supplement over the surface will produce a spotted color.
- Sprinkling saw dust or other absorbent material over the wet, stained surface will produce darker colors.

✓ **NOTE:** New concrete will produce more outstanding colors than old concrete.



OBJECTIVE 6

List safety guidelines for applying stains to concrete.

Chemical stains and acids are highly corrosive materials and should be used with extreme caution. They not only have the potential to cause harm to the individual using them but also to the environment. Thus, they should be used with extreme caution. Safety guidelines are as follows:

- Wear protective clothing such as rubber gloves, boots and splash goggles or a face shield.
- Avoid breathing acid vapors and provide proper ventilation and respiratory protection to prevent inhaling acid fumes.
- Never add water to acid when diluting. Always add acid to water.
- Mask off and protect all surrounding surfaces that might suffer splashes or spills.
- Dispose of leftover acid and containers according to the manufacturer's recommendations.
- Wash thoroughly after handling stain and acid.
- If chemicals come in contact with eyes or skin wash thoroughly. If symptoms persist get medical attention immediately.
- Do not reuse empty containers.
- In case of spillage, cordon off the area, stop the spillage and remove with wet vacuum or absorb with inert material.
- If chemicals are released into soil or water, notify local regulatory authorities.

OBJECTIVE 7

Complete Job Sheet 1.

OBJECTIVE 8

Complete Job Sheet 2.





Name _____ Score _____

OBJECTIVE 7

Apply an acid-based chemical stain to a slab.

BASIC SKILLS



Employability

EQUIPMENT AND SUPPLIES

- Surface to be worked
- Acid stain
- Pressure washer
- Rotary floor machine or walk-behind scrubbing machine with buffing pads of varying coarseness
- Hand-pump sprayer
- Medium nap roller
- Sealer
- Stiff-bristled scrub brush with uncolored bristles
- Protective footwear
- Acid-resistant non-leaking wide-mouthed plastic pails
- Wet shop vacuum
- Masking material
- Litmus or pH paper
- White cloth
- Personal protective equipment

✓ **NOTE:** Refer to CFR (Code of Federal Regulations)1926 Construction Industry Safety and Health Regulations.

PROCEDURE

Yes No

1. Clean and open the concrete surface so the stain can penetrate.

✓ **NOTE:** The surface should be clean and free of any coatings, paints, waxes or curing compounds. Pressure washing or scrubbing with a rotary floor machine using the appropriate buffing pad is normally required. New concrete should be cured for a minimum of 7 days before staining.



Yes No

- 2. Protect all surfaces adjacent to the work area from spills, over-spray or runoff.
- 3. Read the manufacturer's directions for the stain. Prepare the pump sprayer.
- 4. Working as a team, one finisher should spray the stain evenly as another finisher uses a brush to scrub it into the surface. (Figure 1) If you're applying the stain directly from the container, use a wide-mouth, non-leaking, plastic container. Don't allow the stain to run down the sides of the container and drip to the surface or collect under the container. This can cause unsightly stains.

✓ **NOTE:** Try to spray away from the taped area so the stain doesn't leach under the tape.

FIGURE 1



- 5. Keep the brush in constant contact with the surface using a circular or figure eight motion. If you're applying more than one color, wash the surface between applications so you can evaluate the color effect before the second application.
- 6. Allow the stain solution to remain on the surface until the chemical reaction is complete. This process may require a minimum of four hours.



Yes No

7. After the application, neutralize and completely remove all residue using a solution of baking soda and water with a wet shop vacuum. (Figure 2)

FIGURE 2



✓ **NOTE:** The solution should be one-pound baking soda per five gallons of water. You can also use a commercial neutralizing solution.

8. After neutralization, rinse the surface thoroughly with clean water and vacuum. Repeat several times to remove soluble salts.
9. After rinsing, perform a pH test using litmus paper or pH paper to verify that no residue remains. (Figure 3) A pH between seven and eight is required in order for sealers to work properly. Check the manufacturers recommendations for the type of sealer you will be using. Wipe the surface with a white cloth. If residue appears on the cloth, continue rinsing. Failure to remove all residues prior to sealing will cause defects in the appearance, serviceability of the surface, and bond of the sealer.

FIGURE 3



Yes No

- 10. Seal the surface using a clear sealer or one designed for stained surfaces. Apply according to the manufacturer's recommendation. Be sure to back-roll the slab for even coverage.
- 11. Ask your instructor to evaluate your work.
- 12. Clean up the area and put away tools and materials.

PRODUCT EVALUATION

SKILL TEST RECORD

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety	4	3	2	1
Use of Tools	4	3	2	1
General appearance	4	3	2	1
Overall performance	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Profile of Training Mastery, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

- 4 Skilled** — Can perform job with no additional training
- 3 Moderately Skilled** — Has performed job during training program; limited additional training may be required
- 2 Limited Skill** — Has performed job during training program; additional training is required to develop skill
- 1 Unskilled** — Is familiar with process, but is unable to perform job



**EVALUATOR'S
COMMENTS**





Name _____ Score _____

OBJECTIVE 8

Apply a chemical stain to a design scored into a concrete slab.

BASIC SKILLS



Employability

EQUIPMENT AND SUPPLIES

- Surface to be worked
- Selection of different colors of chemical stain
- Foam or chip brushes of various sizes
- Protective footwear
- All-plastic hand pump sprayer
- Wet shop vacuum
- Rotary floor machine or walk-behind scrubbing machine with buffing pads of varying coarseness
- Masking material
- Personal protective equipment

✓ **NOTE:** Refer to CFR (Code of Federal Regulations) 1926 Construction Industry Safety and Health Regulations.

PROCEDURE

Yes No

1. Completely clean and open the concrete surface. The surface should be clean and free of any coatings, paints, waxes or curing compounds. Pressure washing or scrubbing with a rotary floor machine with the appropriate buffing pad is normally required. New concrete should be cured for a minimum of 7 days before staining.



Yes No

2. Before staining, mask off any areas that need to be protected. Tape to the inside of the cut. (Figure 1)

FIGURE 1



3. Read the manufacturer's directions for stain. Use the stain, brushes and hand sprayer to add color to the design. (Figure 2)

FIGURE 2



4. Allow the stain solution to remain on the surface until the chemical reaction is complete. This process may require a minimum of four hours.



Yes No

5. After the final application, neutralize and completely remove all residue with a wet shop vacuum. Use a solution of baking soda and water. The solution should be one-pound baking soda per five gallons of water. You can also use a commercial neutralizing solution.
6. After neutralization, wash the surface thoroughly with soap and water while another finisher vacuums. Thoroughly rinse the surface with clean water and vacuum. Repeat this process several times to remove soluble salts.
7. After rinsing is complete, perform a pH test using litmus paper or pH paper to verify that no residue remains. A pH between seven and eight is required. Wipe the surface with a white cloth. If residue appears on the cloth continue to rinse the surface. Failure to remove all residue prior to sealing will cause defects in the appearance and serviceability of the surface.
8. Seal the surface using a clear sealer or one designed for stained surfaces. Apply according to the manufacturer's recommendation. Be sure to back-roll the slab to ensure even coverage.
9. Ask your instructor to evaluate your work.
10. Clean up the area and put away tools and materials.



**PRODUCT
EVALUATION**

SKILL TEST RECORD

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Use equipment according to safety practices	4	3	2	1
Use tools properly	4	3	2	1
Create a color design that indicates an understanding of the staining process	4	3	2	1
Followed the correct procedures after staining is complete	4	3	2	1

**AVERAGE
RATING**

Evaluator note: To obtain an average rating for the Profile of Training Mastery, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

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**EVALUATOR'S
COMMENTS**

