

METAL ENAMELING



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Welcome!

As a leader in the 4-H Metal Enameling Project, you only need an interest in young people and metal enameling to be successful.

To get started, contact your county University of Wisconsin-Extension office for the 4-H leadership booklets 4H350, *Getting Started in 4-H Leadership*, and 4H500, *I'm a 4-H Project Leader. Now What Do I Do?* (also available on the Wisconsin 4-H Web Site at <http://www.uwex.edu/ces/4h/pubs/index.html>).

You don't need a visual arts background to be a project leader. For a good introduction to 4-H visual arts, plan on attending the 4-H Arts Leadership Lab held at Upham Woods Environmental Education Center, Wisconsin Dells, each year. This lab is aimed at new and emerging arts leaders. For more information, contact your county Extension office.

Following are some things you can do to help youth get the most out of this project:

- Become familiar with the materials referred to in this guide.
- Help youth select goals they can likely achieve.
- Help them decide what tools, equipment and supplies they will need and what they can realistically expect to have.
- Help them understand and learn how to do the tasks they must do to carry out their plan. Do *not* do their work for them.
- Assist them in scheduling their time.
- Discuss progress with them occasionally.
- Help them recognize a good job from a poor one.
- Commend them on things they have done well. A pat on the back from you is one of the highest rewards they can receive.
- Help them understand where they need to improve.
- Help them to know themselves, their strengths and weaknesses, and to compete with their own abilities.
- Help them to evaluate what they have done and what they have learned on the basis of the goals they set. Do not compare their progress with others. Each is unique and needs to be treated individually.
- Discuss responsibility to other youth in the project: cooperation, promptness, sharing, respect for safety, return of borrowed materials, etc.

Be sure all youth are familiar with 4H158, *Metal Enameling Member Guide*. The guide suggests some tools (soldering irons and propane torches), materials and methods which are more appropriate for older youth and more suitable for larger facilities (school art room or spacious county center), rather than your kitchen or basement. Rearrange these recommendations to best suit the ages and abilities of your group's membership and your own comfort level as helper.

As in any art project, a generous supply of tools and materials is wonderful, but not always easily available. You need not purchase all the items listed in this guide. Talk to your county Extension office about helping you find project leaders who may give or lend you some of the items. Get the word out in your county's newsletter. Talk about your needs and you'll be pleased at how many will respond.

BEFORE EACH MEETING: CHECKLIST

Facilities

Check on all the facilities at the meeting place. You'll need:

- a. *Table space*. Set up three or four different work areas for the group.

At *one* area, youth select and cut pieces of copper, file the edges and clean the surface of the metal. (Take care to keep bits of steel wool, metal filings or other dirt from flying back onto clean surfaces.)

At the *second* area, the design and application area, place all the vitreous glass and enamel powders. Here youth can apply the powder to and design on the copper. This area must be very neat and clean. Easy access to a sink is also helpful (see below). Purchased pre-cut pieces of metal, usually copper, is a convenience but must also be thoroughly cleaned to remove all oils used during milling. Simple circles, squares and rectangles are available in various sizes conducive to good design. Pre-cut animal shapes and the like will seriously limit design and exploration. Also, such pre-cut shapes tend to suffer more from burn-out due to the warping of their various small projected parts (feet, tails, fins, beaks, etc.), causing the enamel to fall away and the metal to oxidize.

At a *third* area, the firing area, place the torches and kilns.

If you have plenty of room, a *fourth* area might be set up for cleaning the backs and soldering on the findings. If space is scarce, the soldering can be done in the firing area and cleaning can be done in the first area. You must have at least three distinct areas as outlined above to do successful work.

- b. *Table protection*. Tables selected should be sturdy and easy to work on. Unless made of easily cleaned Formica-



like material, all areas should be protected first by newspaper, butcher or craft paper. At areas three and four, overlay the paper with a heat-resistant material. It is best to raise this board an inch or two from the table surface by setting it on small blocks of wood or on bricks.

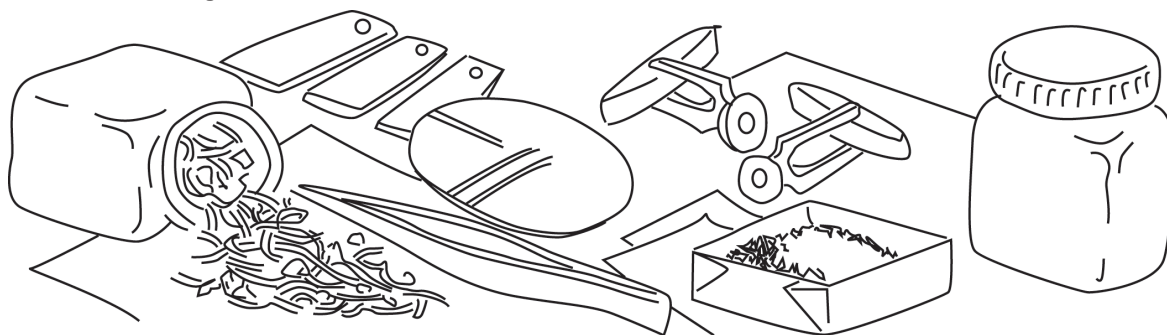
- c. *Water supply.* Water is needed to “wash” the metal at various stages, to moisten surfaces, dissolve and mix solutions, and to wash up after you’ve finished.

Tools, Materials and Equipment

See that all tools, materials and equipment are ready for use. The following list is a guide, more or less complete. As you plan for your 4-H project, you will need to make your own list that best suits youth skills and goals. (See Image 1.)

- Pieces or sheets of 16 or 18 gauge copper; fine (pure) silver; or, pre-coated or unfinished enameling iron tiles or panels. Copper tooling foil may be used for special textural effects. If you choose silver sheet or wire, remember it melts at a lower temperature than copper.
- Metal cutters, small tin snips, various size and style metal files and rasps, deep or piercing Jeweler’s saws with blades of appropriate types (2/0 for copper, 3/0 for silver).
- Sandpaper, emery cloth, nylon scouring sponges or cloths, or other synthetic “steel wool”; 150 and 200 grit “Alundum” stones; “Fiberglas Rush” cleaning tool or stick brush; “Bright Boy” rubber abrasive stick; smooth and rough Carborundum stones. Metal steel wool should be avoided because the fine wires tend to fly about and contaminate work nearby. Of course, steel wool can be used out of doors or at a place far away from the work area.
- A paste of pumice powder and water; coarse (Kosher) salt and white vinegar; non-lotion detergent liquid (like Palmolive Green); non-chlorinated non-abrasive scouring powder (like Bon Ami); Amaco metal cleaner or Amaco copper powder cleaner; and various small stiff brushes, such as, old toothbrushes or fingernail brushes; nylon scrubbing pads; “Sparex #2” or other pickle solution as indicated in Safety section (acids).
- Adhesive gum, such as, “Klyr-fire”; “Amaco-gum”; agar, tragacanth or Arabic gum solutions as in recipes given below; hair set gel or old fashioned wave setting solution. Oil of Spike, Lavender oil, Squeegee oil, Oil of Clove or Amaco Enameling Oil is useful in some techniques, such as, Grisaille and Limoges.
- “Scalex,” “Scale-Off,” or “Amacote” for fire-scale formation (oxidation) prevention. Using tongs or tweezers, very small pieces may be dipped in a saturated salt solution, if nothing else is available.
- Various small, round, flat and soft inexpensive paint brushes for applying gum or scale preventer or for painting techniques.
- Electric kiln for enameling: front loaded, table top size (preferably with pyrometer and controller), or small enamel kiln, hot plate style with lift-off lid. (Optional: propane torch and tripod or coffee can kiln as described in 4H158). Though gas kilns are available, they are not common.
- Eutectic solder for silver (melts at 1460 degrees F), soldering torch, etc., needed for optional soldering procedure. Ordinary solder will not work as it melts at a temperature lower than that needed to fuse/melt the enamel powder to the metal.
- Non-combustible plywood board, furnace floor blanket or similar heat resistant surfacing material for placing on worktables to receive hot items from kiln for cooling.
- Nichrome steel wire racks; steel trivets or ceramic stilts; heavy steel firing forks and spatulas; old steel sole-plated iron (discards are often available at garage sales) to use as a weight on pieces removed from kiln to prevent warping.
- Homemade or purchased enameling inlay tools; discarded dental tools; wooden sandwich picks; tweezers (various sizes); small embroidery size scissors; homemade or

Image 1: Basic enameling tools



purchased enamel sifters, with 60 mesh brass wire screen. Some suggest sifters made of nylon 60 denier hosiery but there are frustration and problems here. You may, however, epoxy or heat/melt weld brass or stainless steel mesh or screen discs to aerosol and other plastic caps which have had their tops cut out and thus make a set of various sized sifters.

- Vitreous glass lumps, threads and enamel powder colors (opaque and transparent) that are non-lead bearing. Some opalescent and crackle colors are also available. The latter work best on curved surfaces. A mortar and pestle are needed if one intends to grind the frit to 80 mesh or if one wishes to grind purchased (80 mesh) enamel to 180 or 200 mesh for use in some of the painting techniques (Limoges, etc.).
- Industrial heat resistant gloves of leather or Teflon.
- Jeweler's metal hole punch or a hand drill and bits for making holes in pendants, bracelet links, etc.
- Protective goggles, shop glasses, dust mates, gloves and shop aprons as needed (see Safety section).
- Jeweler's or craft pliers (miniature or small sized) and cutters with various style jaws: flat, round, chain and various cutter styles, etc.
- Findings: earring backs, pin-backs, jump rings, tie tacks, etc.
- Clean white scrap paper (may be recycled paper) for use as a carrier or a mat under the metal form while dusting-on the color. The excess glass dust can then be checked for cleanliness and, if acceptable, saved for re-use. Otherwise, it can be used for counter enamel.
- Soft "Kleenex" type tissue for blotting excess water out or off of metal while wet-packing (or inlay of glass powder).
- Bond paper; "Pellon" type dressmaker's fabric or "contact" paper to use for block out stencils. Acetate or clear polyester vinyl sheet used for print-making stencils may also be used. Stencils are cut with scissors, single edge razor blades or "X-Acto" knives; or for the acetate or vinyl, with a heat knife or wood burning tools.

Resource Materials

Check on your resource materials: books, pictures, slides and samples of artwork. Use these in such a way that youth do not merely copy or imitate your samples. Creative thinking, not merely producing some enamel object, is the main purpose of this project. Plan a field trip to a museum, gallery or artist's studio to examine historical or modern works. Consult 4H402, *Art in a Box Leader Guide*, and 4H401, *Art in a Box Activity Book*, available through your county Extension

office for further discussion of the creative experience for youth.

Expenses

Plan how you will charge for the material and when money is to be collected. Some clubs allot funds from their treasury, some hold fund-raisers, while others merely divide costs equally among participants. Proportional assessments based on amount of materials used can also be determined. Include estimated cost of use of electricity and delivery or postage fees as needed for the materials ordered.

Planning

Plan how you will distribute tools, supplies, etc. You need to be sure everything is returned to you in good condition. In your planning, be sure to allow for setup and cleanup time, as this is part of their learning experience, not yours! If you have a very large project group, you may need to require "reservations" for work days and hold youth to their agreed upon schedule, allowing others to "fill in" when someone can't attend.

Youth Leaders

If you're expecting to work with more than six youth, select some older youth leaders to assist you. Work with them beforehand so they will be trained and responsible for some "lessons" and tasks. That will relieve you of much of the load. You ought to have one assistant per six youths.

PROJECT MEETINGS: CHECKLIST

Talk to your county 4-H staff about "planning a project meeting" ideas and materials if you'd like assistance beyond what is listed below. No attempt is made here to tell you how much should be completed at each meeting. Groups and individuals vary widely. The following is merely a list of items that could be taken up in a series of meetings. Depending upon the group and the difficulty of the projects, as many meetings as necessary should be held. Do not rush the instruction. Do not let county fair deadlines determine the overall quality of the project experience. Plan ahead.

Purposes of 4-H Arts and Crafts

- a. To give youth training in creative thinking. Experiences in planning, experimenting, researching, problem solving, choosing among options, dealing with consequences, etc., are all significant parts of this process.
- b. To give them confidence in making something of their own creation with their own hands.
- c. To make them better consumers of manufactured and hand-made articles by better appreciation of the processes, materials and skills involved.



d. To give them some ideas regarding future career choices.

NOTE: It should be stressed that the object made is only a by-product of the important “doing” experience; the process is paramount. The object is important, of course, but if the above points aren’t considered, the product has little value.

Components of Good Metal Enameling

a. It is usable, as well as artistic or decorative. (See Image 2.)

- On jewelry, the findings must be securely held in place. Some glued findings may break loose with wear. Rather than soldering, many of the “glues” available today will adequately bond glass and/or metal to metal. Two-part mix Epoxy, GE or Dow-Corning clear silicone auto glass glue and seal, and liquid solder glues are good choices. However, be certain that all instructions and labels are carefully followed for safe use, as well as permanence. (Of course, a silver soldered bond melds metals and should be superior.)
- If utilitarian, it does what you made it to do (hold a tie in place, acts as a cuff link, fits well as a light-switch plate, etc.). It is not too bright or too large so it cannot be worn; for example, it suits the coloring, costume, hair style, etc., of the wearer. The design suits the function. If it is to be used as a plate or container, only non-lead bearing enamel is used.

b. It is aesthetically pleasing. It evidences a creative understanding of design as well as respect for materials. Even if it is a non-utilitarian object, it is completed and is ready for presentation. It must fit well in or on its frame or base. If an enameled “picture,” it looks complete and stands alone or can be hung. This applies also to objects such as sculpture and enamel mobiles.

c. It is made as skillfully as possible. The transparent and opaque qualities of the enamels, the fired quality of colors fusing together, and the shiny or crystalline quality of the glass are all considered. The enamel is not applied on metal parts that are too thin or pliable. The strength within fragility of glass has been observed. Bare metal surfaces have been polished clean.

- d. Its design has clarity. It is plain and simple, not overly ornate.
- e. It is personal and individual. It isn’t copied from anything or anyone. It is the youth’s own idea.

How to Start Working

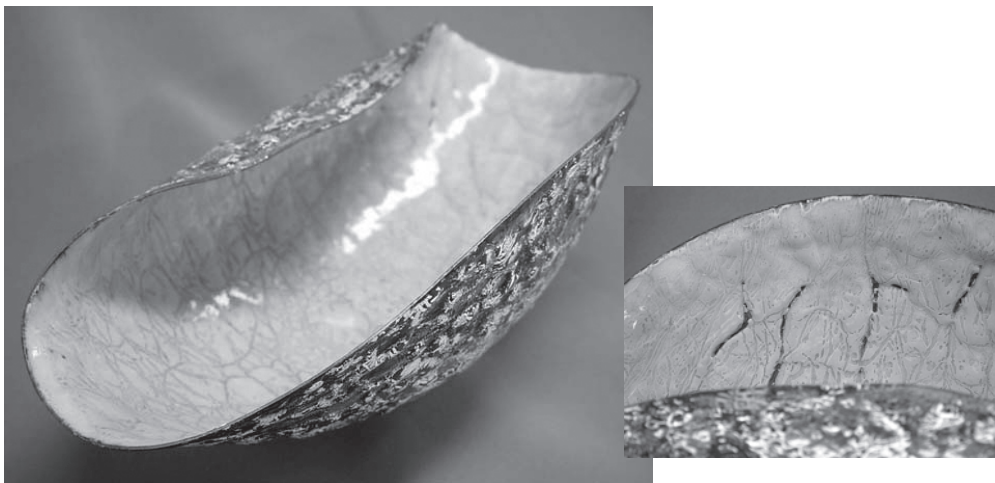
- a. Gather ideas. Visual brainstorming is called for! This may involve field trips, library browsing, a box or sketchbook in which to keep ideas, notes, scraps of color or texture, and drawings of favorite things. This step goes on for varying periods of time prior to the actual “working” project meetings.
- b. Have youth discuss the project they think they would like to make. Have them talk about what they hope to do. What are they trying to convey or get across to the viewer? If “useful,” how can they make it function best?
- c. Be sure that the different operations are kept separated from each other and that work areas are kept orderly, clean and neat. Help them show respect for neighbors and their work.

Prepare a Project Plan

(what each member is expected to do during the year).

- a. Describe the steps necessary to prepare an enamel piece and show the development of increasingly skilled ease with materials and tools.

Image 2: This bowl is usable as well as artistic.



- b. Become familiar with various methods of designing and manufacturing the final object:
- Applying powder directly with the fingers (trailing) and with tiny spatula-like tools.
 - Sifting on solid areas of color.
 - Using glass lumps or threads.
 - Imbedding wire and other metal pieces into the glass.
 - Using a stylus or similar tool to sgraffito (incise or scratch away) a design of lines or spaces on a fired base color.
 - Using a block-out stencil.
 - Combining opaque and transparent enamels in a design.
 - Cutting and using stencils for various colors at one firing and at a series of firings.
 - Applying enamel powder to a curved surface.
 - Painting in the Limoges or the Grisaille (chiaroscuro or gray) method.
 - Using the cloisonné (partitioned cells or cloissons) technique.
 - Using the champlevé (raised field) method.
 - Using the basse-taille (low cut) method.
 - Using the plique-à-jour (braid-filtered daylight or stained glass look) technique.
- c. Demonstrate proper cleaning and finishing methods.
- d. Be familiar with methods of fastening the jewelry findings. Select adhesives and findings most appropriate to the work. Older youth may wish to learn “soldering” methods suitable to firing temperatures of copper, steel, silver and glass.
- e. Aim to make six to 10 different enameled objects. Adequately finish both the edge and the back of each object. Remove all fire scale.
- f. Demonstrate proficiency with:
- Preparing a series of practice tiles which show colors fired over bare metal and glass flux, on foil and various whites.
 - Using ground up colored vitreous glass lumps, sifted and prepared for use by the member (ground to a specific mesh, washed free of “fines”).
 - Showing several of the ways of creating designs as listed above.

Again, care should be taken to encourage the youth to use good technique and to try new and individual approaches. Youth should be urged to give metal enameling *demonstrations*. They could show only a part of the process in a demonstration or they could go through all the steps.

Demonstrations could be given to your own or other groups, parent and farm groups, school classes, or scout and church groups. Youth should always stress the *creative* and *personal* elements of the process. The planning for such a presentation will serve to verify the member’s knowledge as well as serve as an opportunity to communicate that knowledge.

Evaluation of Projects

Continuous self-evaluation should be carried on while youth are making the objects. There should be a very honest mutual evaluation among the youth at the end as well. You may use the points listed in the project record sheet as a guide. Ask your county 4-H staff, key leader or state 4-H arts specialist for advice and materials that will help you work with the youth to demonstrate constructive evaluation based on age-appropriate expectations.

An excellent opportunity for quality evaluation is your annual county fair art and crafts show. This is a good time to exhibit projects and have youth’s questions answered during face-to-face judging. By observing and listening to a judge working with exhibits, one gains insights and hints as to presentation, design and judging criteria. Following are some criteria that judges often use to evaluate metal objects at a county fair:

Metal art and jewelry: general

- Creative, authentic, original design.
- Design is appropriate to medium and use.
- Findings and other devices are appropriate and secure.
- Inventive combination of materials and/or techniques.

Metal art and jewelry: beadcraft

- Even knotting, weaving, or other joining.
- Endings are hidden or incorporated into design.
- Findings attached securely.

Metal art and jewelry: cast or fabricated metal art

- Properly finished; rough or sharp edges smoothed, cleaned, and polished.

Metal art and jewelry: metal enameling

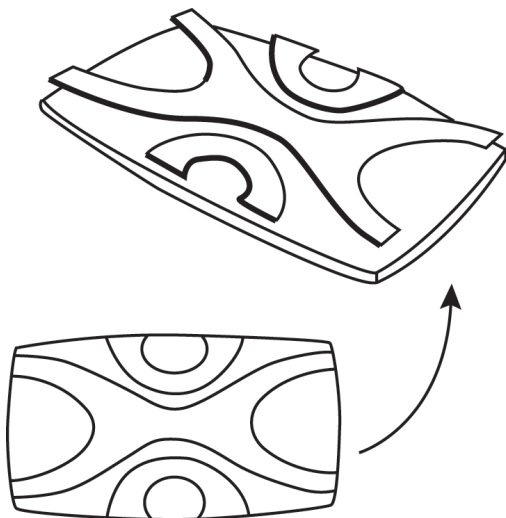
- Proper finish evident.
- Enamels clean and bright, properly applied; firing effective.
- Back or underside enameled, lacquered or waxed, if needed.
- Scale cleaned; metal polished.



KILN PREPARATION AND MAINTENANCE

- Use kiln-wash coating (Porcelain Furnace Wash) to protect the fire brick floor of the kiln from enamel drippings. Never try to chip old drips off the kiln floor – this can cause damage. This product mixes with water and is brushed on, but must be applied well in advance of the day the kiln is to be used. See instructions from distributors. (Newer kiln linings of synthetic materials can not be repaired in this way.)
- Allow sufficient time to fire up your kiln (up to 1-1/2 hours for some models) before you use it.
- When inserting or removing work, be sure not to let tools or trays touch the kiln's coils. Do not allow molten glass to come in contact with coils or pyrometer (sensor) inside the kiln.
- Kiln should be allowed to cool down slowly and should be moved about carefully to avoid damage to fire brick, coils, wiring, thermostat, pyrometer, etc. The kiln door or lid should be closed gently – not slammed! Should a kiln suffer damage, contact your county 4-H youth development agent, key leader or other experienced person regarding repair or replacement of parts. Kilns are expensive and there are real safety concerns.
- Do not use extension cords with large kilns or small table-top units, unless made of extra heavy duty heat-resisting material made especially for that purpose.
- Do not use kilns for any other purpose than enameling.
- If using a small glass-top hot plate kiln (furnace), do not let the glass top (Pyrex-type) come in contact with water or other liquid while hot. The glass could break.

Image 3: Adhesives can also be used to hold stencil pieces to the enamel surface.



ADHESIVE AGENTS OR BINDERS

- Adhesive gums are used in enameling to help hold the glass powders in place on the metal pieces, until they are fired. The gum should be just barely tacky and not glue-like. Apply only enough to cover the metal. Do not leave a puddle or flood the metal. Brush in one direction only, to avoid forming bubbles; do not “scrub” on. (See Image 3.)
- The recipes or formulas given below should substitute for the more expensive commercial solutions, such as, “Klyr-Fire” and “Amaco Gum.” If they are to be held for a year or more, it is probably wise to add a preservative. Materials are available from a pharmacy, art supply store or high school science teacher.
 - a. 3/4 oz. gum tragacanth flakes and one quart of water; or, 3/4 oz. gum Arabic powder and one quart of water: Soak flakes or powder about 24 hours. Strain through a cloth bag, screen or filter paper. If the solution is too thick, add water and repeat soak and straining. As the solution stands, the air bubbles will dissipate. A few drops of carbolic acid or other preservative may be used.
 - b. 1/2 oz. flake or powdered agar and one gallon of water: Bring solution to a boil, stirring constantly. Let stand overnight and strain as above. A few drops of alcohol may be used as a preservative.

SAFETY PRECAUTIONS

Please refer to a recent edition of *Health Hazards Manual for Artists* by Michael McCann or *The Artists' Complete Health and Safety Guide* by Monona Rossol. These are helpful for any 4-H arts and crafts projects.

Kiln Firing and Table-Top Units

- Set up your work areas in a well-ventilated room. Do not store flammables in this room. Heat from the kiln, hot plate-type furnace or torch could ignite fugitive vapors.
- Never leave a fired-up kiln unattended. Though rarely, a kiln could overheat! Pay attention to the temperature gauge. Models without controls may need to be unplugged temporarily in order to bring the temperature down.
- Keep the space around, behind and above the kiln uncluttered. Also, this area is not a place for youth to socialize.
- Place a heat-proof material on surfaces near the hot plate, furnace, kiln or torch so that fired pieces or tools can be set down quickly and smoothly while they're hot. Though asbestos board is no longer recommended, you



might consider the following materials: combustion-proof plywood, furnace floor blanket, steel sheet, insulating firebrick or cement board.

- Do not leave project pieces, tools, racks, etc., just removed from the kiln, unattended. These objects may look cool but will cause severe burns if picked up too soon.
- Always wear industrial leather (welding type) heat resistant gloves, not ordinary asbestos gloves or mitts. Ordinary kitchen or barbecue hot pads and mitts will *not* suffice!
- Work from a standing position so that you can move back or away quickly, should anything fall.
- Only use spatulas, racks, trivets, firing forks, etc., of suitable length, strength and balance (probably not ordinary kitchen or BBQ tools).
- When opening the kiln or looking through the peep hole, do not *stare* at the exceedingly bright coils or molten enamels unless wearing ultraviolet protective lenses or welding goggles (#14 type lens).
- Be sure long hair is tied back; loose flowing parts of clothing or jewelry should be avoided or secured. Don't forget that feet should be protected from hot falling items – this is not a place for sandals!
- Particular standards and practices apply to using a *torch* for firing enamels or soldering metals. Consult handbooks or web sites on metalworking and jewelry making. Note that glass (enamels) and copper or fine silver melt at specific temperatures and require appropriate compatible materials and methods (not the same as soldering your plumbing “around the house”).

Metal Cutting and Cleaning

- Handle cutting tools with respect. Demonstrate beforehand, the proper use of snips, saws, punches and other shop tools and equipment. Wear correct safety glasses to avoid harm from flying fragments and particles. Wash hands frequently or wear gloves.
- When using Rush Fiberglass cleaning tools, try to avoid touching fingers to your face or eyes until hands are washed clean, as the glass fiber rods are an irritant.
- Never eat or drink in work area.
- Use correct tongs for dipping metal in Sparex #2 (sodium hydrogen sulfate) or acid (nitric or sulfuric) solution for cleaning (pickling) or etching (biting) as in *champlevé*. This avoids undesirable metal transfer or “plating.” For heating these solutions, use intact baked-on enamel pots

or burner-proof glass (like some Pyrex) or ceramic (like some Corning ware) stove-top pots. Proper plastic or rubber gloves and aprons, adequate ventilation and masks against toxic fumes and splashes may also be needed. Also, carefully attend to the mixing, storage and disposal of such toxic materials. Contact your county 4-H staff for advice.

Application of Enamel Colors

- Use a protective toxic dust mask when working with enamel powders for extended periods. Have youth avert his or her face while leaning away during brief dusting on of powder.
- Never eat or drink while enameling. Wash hands before and after working.
- A clear uncluttered work space is conducive to good work and good safety practices.

Other Cautions

- Metallic lusters, glass etch and other materials are more properly used by adults because they pose special hazards. Also, there are special safety rules for using patinas, metal colorants, some caustic degreasers and soldering fluxes. Electroplating and anodizing methods involve both electrical and chemical dangers. Gilding and Niello-produced fumes are dangerous and best done by adults in proper workshops, labs or studios.
- Keep the working group small. Large groups need other strategies, such as an assembly-line setup, and more youth leader or parental assistants (that you have trained or run through the process) in order to control traffic, etc.

METAL ART AND JEWELRY TERMS

Annealed – process of heating a metal to make it less brittle.

Bead craft – daisy chain, beaded tubing and loom work.

Champlevé – enameling technique where metal has been etched or carved away and the resulting depressions filled with enamel.

Chasing – art of ornamenting metal with individual strokes of a hammer on chasing tools or punches.

Cloisonné – enamel surface embellishment where the colors are separated by thin metal strips (forming *cloisonné*).

Cold forging – forming metal which has been annealed and cooled.

Electroplating – coating with metal by electrolysis.

Enameling – glass fused to metal.



Filigree – ornamental openwork (as of fine wire).

Flux – substance used in soldering.

Forging – to form metal by heating and hammering; fashion and shape.

Inlay – to set onto a surface or ground; especially for the purpose of decoration.

Kiln – heated space to burn, fire or dry materials, i.e., fire a piece of enamel to melt and fuse into a glassy finish.

Laminating – to make by uniting layers of one or more materials.

Lapidary – cutting and polishing of gemstones.

Limoge – painted enamels.

Niello – black enamel-like alloys usually of sulfur, with silver, copper and lead; used to decorate incised designs.

Patina – thin layer of green oxidation appearing on copper; can be produced by age or chemical process.

Pickled – acid used to remove oxidation from metal.

Plique a jour – enameling technique where transparent enamels are placed in a wire framework giving a stained glass effect.

Repousse – decorating the surface of metal by hammering the reverse of the object, design refined by chasing.

Solder – metallic alloy used to join other metals together.

Soldering – joining metal pieces together using solder as a flux to fuse pieces together. (See Image 4.)

Tole – sheet metal and tinplate used in fabrication of domestic and ornamental wares.

Welding – to fuse metal either by heating and allowing it to flow together or by hammering and pressing together.

Image 4: These metal bat pieces are soldered together.



FURTHER LEADER TRAINING

Check with your county Extension office for periodic metal enameling training available at 4-H leader workshops. Also check out art courses offered at UW campuses and technical colleges in your area. Following are some suggested sources of supplies and other resources.

Sources of Supplies

Amaco (American Art Clay Co., Inc.), 4717 W 16th St., Indianapolis, IN 46222; phone: (800) 428-3239 or (800) 358-8252. On the Web at <http://www.amaco.com/jsps/amacohome.jsp>. Catalog available.

Dick Blick, PO Box 1267, Galesburg, IL 61401; phone: (309) 343-6181 or (800) 723-2787. On the Web at <http://www.dickblick.com/>. Catalog available.

Nasco, 901 Janesville Ave., Fort Atkinson, WI 53538-0901; phone: (414) 563-2446. On the Web at <http://www.enasco.com/>. Catalog available. Worth a visit if convenient for your group.

Sax Arts and Crafts, PO Box 51710, New Berlin, WI 53151-0710; phone: (800) 558-6696 or (414) 784-6880. On the Web at <https://www.saxarts.com/index.jsp>. Catalog available.

Thompson Enamel, PO Box 310, Newport, KY 41072; phone: (800) 545-2776 or (606) 291-3800. On the Web at <http://www.thompsonenamel.com/welcome/main.htm>. Best mail order source with the most informative catalog available. Quick and informed service even by telephone.

Various crafts and hobby stores, art material or display shops in your area may be of help. Also, talk to your local school art teacher. Sometimes hardware, paint and wallpaper and department stores carry craft materials. Catalogs are often good sources of descriptive and detailed information. Those listed here are among the best and may be sent to you on request. Let them know you are a 4-H leader and they may send a catalog at no charge.

Bibliography

The following books, periodicals and web sites are excellent resources and/or step-by-step guides. The list is long to give you alternatives in case you can't find a title. Many of the books are no longer in print but should be available through local libraries. Talk to your librarian about accessing specific titles. Some are standard texts and have gone through many printings or editions. Consult your bookseller or second-hand book store, garage sales, flea markets and the Internet. You will find that instructions, definitions, favorite materials, choice of techniques, etc., will vary with each author. Browse and pick and choose to suit your needs.



Books, Pamphlets and Periodicals

- Art of Enameling*, Margaret Seeler, Galahad Books, NYC, 1969.
- Basic Enameling*, Lili Taubes, Pitman Publishing Corp., NY, 1970.
- Beginners Enameling Course*, Woodrow Carpenter, Thompson Enamel Division, Newport, KY, 1981.
- Copper Enameling, A Practical Guide*, Louie S. Taylor, A.S. Barnes & Company, Inc., Cranberry, NJ, 1977.
- Copper Enameling*, Gerry Coleman, Marguerite Koenig and Edna Berry, Western Galleries Publishing Company, Fort Worth, TX, 1973.
- Copper Enameling*, Jean O'Hara and Jo Rebert, Professional Publications, Columbus, OH, 1956.
- Enamel Art on Metals*, Edward Winter, University Circle Publications, Cleveland, OH, 1958.
- Enamel Painting Techniques*, Edward Winter, Praeger Publishers, NYC, 1970.
- Enameling for Beginners*, Edward Winter, University Circle Publications, Cleveland, OH, 1962.
- Enameling on Copper and Other Metals*, Thomas E. Thompson, Thomas C. Thompson Co., Highland Park, IL, 1950.
- Enameling on Metal*, Oppi Untracht, Chilton Book Co., Philadelphia, PA, 1957.
- Enameling Principles and Practice*, Kenneth F. Bates, Funk and Wagnalls, NYC, 1951.
- Enamelist*, Kenneth F. Bates, Funk and Wagnalls, NYC, 1967 (Paperback Edition, 1975).
- Enamelists' Handbook*, Elizabeth and Colin Fraser Davies, Pitman Publishing, Auckland, New Zealand, 1988.
- Enamels, Enameling, Enamelists*, Glenice Mathews, Chilton Books, Radnor, PA, 1984.
- Experimental Techniques in Enameling*, Fred Ball, Van Nostrand Reinhold Co., NYC, 1972.
- Family Creative Workshop*, Vol. 6, A.D. Brogdon, Ed., Plenary Publications International, Inc., NYC, 1974, pp. 658-667.
- Glass on Metal – The Enamelists Newsletter*, bi-monthly publication of the Enamelists Society, PO Box 310, Newport, KY 41072.
- Homemade Enamel Jewelry*, Burns and Oates, Herder Book Center, West Germany, 1967.
- How to Enamel on Copper*, Catherine M. Henson, Walter Foster Art Books, Tustin, CA.
- Metal Enameling*, Polly Rothenberg, Crown Publishers, Inc., NYC, 1969.
- Simple Enameling*, Geoffrey Franklin, Watson-Guptill Publications, NYC, 1971.
- Step-by-Step Enameling*, William Harper, Golden Press, NYC, 1973.
- Technique of Enameling*, Geoffry Clarke, and Francis and Ida Feher, Batsford Ltd., London, 1988.
- 4-H Curriculum Used in Wisconsin County UW-Extension offices provide additional resources to help you as a visual arts leader. Check out the following publications: 4H635, *4-H Visual Art*; 4H635A, *Celebrate Art*; 4H635B, *Art in Your Future*; BU7597, *Palette of Fun Helper's Guide*; 4H472, *Palette of Fun Member Sheet and Introduction*; and Pub No. 23112, *Elements and Principles of Design*. In addition, check out the Wisconsin 4-H Web Site art project page at <http://www.uwex.edu/ces/4h/onlinpro/art.html>.
- Members may need your help in planning their project work. An excellent tool is the *4-H Member Project Plan & Evaluation Form* (MPE), available at <http://www.uwex.edu/ces/4h/pubs/index.html>. If you want to help members keep records of their project expenses and income, check out the financial record forms for junior and senior members (FR01 and FR02) at this same site.

Web Sites: Metal Art and Jewelry

- Metalsmithing-related articles and projects: <http://jewelrymaking.about.com/hobbies/jewelrymaking/library/blmetop.htm>. Find information of all levels on soldering, fabrication, and other metalsmithing topics.
- Navajo Indian Silversmithing: <http://www.indianvillage.com/stories/Silversmithing.htm>.





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Created by James Schwalback, former Extension Arts Specialist; revised by Mary Demeter Thurrell, Dane County Cultural Arts Volunteer Leader. Updated by Wayne Brabender, Wisconsin 4-H Distance Learning Specialist. Layout and design revised by Dana Kopydlowski, 4-H Youth Development Graphic Artist, August 2004.

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