Ceramics Safety Manual

Poison Control: 1-800-222-1222

HACC Security/Emergency number: 780-2568

HACC Department of Environmental Health and Safety 221.1300 x:1567

If the emergency is life threatening call 911, or ask a professor or secretary to call.

Chemicals enter the body through the skin, inhalation and ingestion. Smoking increases the hazards of respiratory reactions.

Art materials may be:

Toxic, cause physical injury via breathing (inhalation), eating (ingestion), or by skin contact & absorption
Caustic, may burn you on contact
Irritant, cause skin, eye, mucous membrane inflammation or pain
Flammable, can ignite or be set on fire
Explosive, may explode when exposed to heat, pressure or shock

GENERAL PRECAUTIONS:

Do not eat or drink close to work area (to prevent accidental ingestion).
Familiarize yourself with substances that are hazardous.
Clean hands thoroughly after working using baby oil, soap and water, or a non-toxic hand cleaner such as GoJo.
Keep work area clean and organized.
Ask your doctor if you are taking medication or are pregnant about what precautions you should be taking.
Identify location of fire extinguishers, first aid box and eye wash stations (ask your professor if need be).
Notify your professor about any health condition or medication that may affect you in the classroom.

Material Safety Data Sheets (MSDS) are available at https://myhacc.hacc.edu/cp/home/displaylogin or contact the Department of Environmental Health and Safety at 221.1300 x:1567.

Quick Overview of Hazards

Clay Dust - Silica
Glazes - Siica, lead, cadmium and more
Slip Casting - Talc, asbestos
Kiln Firing - Sulfur dioxide, carbon monoxide, fluorides, infrared radiation, burns

MATERIALS

Clay

Clays are minerals composed of hydrated aluminum silicates, often containing large amounts of crystalline silica. Other impurities may include organic matter or sulfur compounds. Sometimes, grog (ground firebrick), sand, talc, vermiculite, perlite, and small amounts of minerals such as barium carbonate and metal oxides, are added to modify clay properties. Clays can be worked by hand or on the potter's wheel, or cast in a clay slurry into molds.

Clay is made by mixing dry clay with water in clay mixer. Clay slip is made by adding talcs which themselves can be contaminated with fibrous asbestos or asbestos-like materials. Geographical sources of talcs are relevant, for example, New York State talcs are notoriously asbestos-contaminated, while Vermont talcs are not. Pfizer has some fiber-free talcs.

Clays and clay additives in the HACC studio are: Fireclay, Om4 Ball Clay, Silica, Spinks, Red Art Clay, Custer Feldspar, Sand, Grog, Talc and EPK Kaolin. Students may be mixing clay 4-5 times a semester, working outside. These clays all have crystalline silica as a component. Crystalline silica may cause scarring of the lung (silicosis) and is carcinogenic. AVOID INHALATION OF THESE PRODUCTS.

PRECAUTIONS

Use premixed clay to avoid exposure to large quantities of clay dust.
Clay mixing should take place outside.
If using an indoor clay mixer it should be equipped with local exhaust ventilation to remove fine silica dust particles from the air.
Clay mixers should be equipped with proper machine guards so that they cannot be opened to add clay or water while the mixer blades are turning.
Wear separate work clothes while in the studio. Choose clothes of material and design that don't trap dust. Wash these clothes weekly, and separately from other laundry.
Avoid contact of clay with broken skin. Use a skin moisturizer.
To prevent back problems, always lift with knees bent.
Keep wrists in unflexed position as much as possible to prevent carpel tunnel syndrome. Take frequent work breaks.
Be careful of the moving parts on kickwheels.
Recondition clay by cutting still-wet clay into small pieces, letting them air-dry, and soak in water.

Finish green ware while still wet or damp with a fine sponge instead of sanding when dry. Do not sand greenware containing fibrous talc.

Wet mop floors and work surfaces daily to minimize dust levels and prevent dry scraps from becoming pulverized and then airborne.

HAZARDS

Silicosis, or lung scarring, occurs over time with the inhalation of various clay products. Symptoms of silicosis include: shortness of breath, dry cough, emphysema, and high susceptibility to lung infections such as tuberculosis. Silica dust exposure is not hazardous by skin contact or ingestion.

Chronic inhalation of kaolin is moderately hazardous, and can result in kaolinosis, a disease in which the lungs become mechanically clogged.

Asbestos is extremely toxic by inhalation and possibly by ingestion. Asbestos inhalation may cause asbestosis, lung cancer, mesothelioma, stomach cancer, and intestinal cancer.

Sand, perlite, grog, and vermiculite contain free silica and are, therefore, highly toxic by inhalation. Vermiculite is also frequently contaminated with asbestos.

Hypersensitivity, pneumonia, asthma, or other respiratory problems may occur with exposure to molds growing in wet clay that is being soured or aged in a damp place, in slips that stand for months, or with inhalation of dry aged clay. Molds can cause or exacerbate skin problems and change the workability of clay.

Throwing on a potter's wheel for long periods of time can result in carpel tunnel syndrome because of the awkward position of the wrists. Pain, numbness and/or pins and needles in the thumb and first three fingers, are common symptoms. Back problems can occur from bending over the potters wheel for long periods of time.

Hand contact with wet clay can result in abrasion and dryness of fingertips and hands. Moving parts of kickwheels can cause cuts and abrasions.

Clay scraps on the floor, bench and other surfaces can dry and pulverize, producing an inhalation hazard due to the presence of free silica. Similarly, reconditioning clay by pulverization and sanding finished green ware, can create very high concentrations of hazardous silica dust.

Glazes

HACC students are not to mix glazes. Contact with glazes is minimal therefore and occurs after glazes have been mixed and are in a liquid state. Safe practices should be followed at this time.

Glazes used to color or finish clay pieces are a mixture of silica, fluxes and colorants. Common fluxes include lead, barium, lithium, calcium and sodium, and are used to lower the melting point of silica. The actual colorants, which are an assortment of metal oxides usually account for less than 5% of the glaze by weight.

Originally, soluble raw lead compounds including red lead, white lead, galena, and litharge were used as fluxes in low-fire glazes. Many cases of lead poisoning were reported in British potters during the ninth century. Lead frits and good housekeeping greatly lowered the number of potters that had been poisoned by these highly toxic lead compounds. Frits are made of melted minerals and metal compounds that are sintered and ground into powder form. While lead frits are sometimes assumed to be insoluble and nontoxic, leaching tests with acids have shown that many frits are as soluble as raw lead compounds and, in fact, there have been cases of lead poisoning from both inhalation or ingestion of these.

High fire porcelain and stoneware techniques eliminate the need for lead as a flux. Also, alkali earth or alkaline earth fluxes can be used for low-fire conditions instead of lead. Silica may also be removed from leadless type glazes. The

substitution can be based on boric oxide as the glass-former, instead of silica. Alkali earth fluxes include sodium, potassium, and lithium oxides; alkaline earth fluxes include calcium, magnesium, barium, and strontium oxides. Minerals containing these fluxes include certain feldspars, nepheline syenite, petalite, bone and plant ashes, whiting, and dolomite.

An assortment of metal oxides or other metal compounds produce particular colors when fired. These are added in such small amounts to the glaze, that they aren't usually a great hazard. Luster or metallic glazes are fired in a reduction atmosphere. These glazes can contain mercury, arsenic, highly toxic solvents such as aromatic and chlorinated hydrocarbons, and oils such as lavender oil. The common metals are often resinates of gold, platinum, silver, and copper. Some underglazes and overglazes use mineral spirits as the vehicle instead of water.

Glaze components are weighed, sorted and mixed with water. These materials are often in fine powdered form, and result in high dust exposures. Glazes can be dipped, brushed, poured, or sprayed on the ceramic piece.

PRECAUTIONS

Use lead-free glazes.

Lead glazes should only be used on non-foodware items. Design lead-glazed pieces so that they won't be used for food or drink. Lead-glazed pottery should be labeled as lead-containing.

If possible, don't use colorants that are known human carcinogens and avoid probable human carcinogens. There is no known safe level of exposure to carcinogens.

Consider wearing a respirator when weighing and mixing powdered chemicals. Wet glazes are not an inhalation hazard. Good housekeeping procedures and cleanup of spills reduce the risk of inhalation or ingestion of toxic dusts. Wet mop spilled powders.

Gloves should be worn while handling wet or dry glazes.

Good dilution ventilation or local exhaust ventilation should be available when applying solvent-containing glazes.

Basic personal hygiene rules should be followed including restricting eating, drinking in the studio , and wearing personal protective equipment such as gloves, and separate work clothes or coveralls. Wash hands after work. Leftover glazes and glaze scrapings can be homogenized, combined, tested, and used as a glaze.

Smoking is prohibited in both indoor and outdoor studios.

HAZARDS

Lead compounds are highly toxic by inhalation or ingestion. Symptoms of lead poisoning include: damage to the peripheral nervous system, brain, kidney, or gastrointestinal system, as well as anemia, chromosomal damage, birth defects and miscarriages. Lead-glazed foodware can leach lead if not fired properly, or if the glaze composition is not correctly adjusted. For example, the addition of copper to lead frits renders a higher solubility of lead in the final fired ware. Acidic drinks and foods such as tomato juice, citric juices, sodas, tea, or coffee, can increase this hazard.
A glaze label marked "lead-safe" means that the finished ware, if fired properly, will not release lead into food or drink. The actual glaze is still hazardous to handle and fire and may contain lead. Other fluxes such as barium and lithium are also highly toxic by inhalation, but less so than lead.

Certain colorant compounds of particular metals are known or probable human carcinogens, including: arsenic, beryllium, cadmium, chromium (VI), nickel, and uranium.

Antimony, barium, cobalt, lead, lithium, manganese, and vanadium colorant compounds are highly toxic by inhalation.

Antimony, arsenic, chromium, vanadium, and nickel compounds are moderately toxic by skin contact.

Free silica occur in many of the clays, plant ash, flint, quartz feldspars, talcs, etc. used in glazes. See the discussion above for the hazards of silica and the disease silicosis. Weighing and mixing glazes can result in the inhalation of these toxic materials.

Soda ash, potassium carbonate, alkaline feldspars, and fluorspar used in glazes are skin irritants.

Spray application of glazes is very hazardous because of the potential inhalation of glaze mists.

Dipping, pouring, and brushing certain glazes may cause skin irritation and accidental ingestion due to careless personal hygiene habits.

Glazes containing solvents are both flammable and hazardous.

FIRING

Electric kilns and gas-fired kilns are used to heat the pottery to the desired firing temperature. The most common type at HACC are the gas and electric kilns. The fuels for gas kilns produce carbon monoxide and other combustion gases. Fuel-fired kilns are usually vented from the top through a chimney.

Electric Kilns use heating elements that heat the kiln as electric current passes through the coils. The temperature rises until the kiln is shut off. Firing temperatures can vary from as low as 1,382°F for raku and bisque wares, to as high as 2,372 °F for stoneware, and 2,642 °F for certain porcelains.

The early stages of bisque firing involves the oxidization of organic clay matter to carbon monoxide and other combustion gases. Sulfur breaks down later producing highly irritating sulfur oxides. Also, nitrates and nitrogen-containing organic matter break down to nitrogen oxides.

Galena, cornish stone, crude feldspars, low grade fire clays, fluorspar, gypsum, lepidolite and cryolite can release toxic gases and fumes during glaze firings. Carbonates, chlorides, and fluorides are broken down to releasing carbon dioxide, chlorine, and fluorine gases.

At or above stoneware firing temperature, lead, antimony, cadmium, selenium and precious metals vaporize and the metal fumes can either escape from the kiln, or settle inside the kiln or on ceramic ware in the kiln. Nitrogen oxides and ozone can be generated from oxygen and nitrogen in air.

PRECAUTIONS

Infrared goggles approved by the American National Standards Institute (ANSI) or hand-held welding shields should be worn when looking into the operating kiln. Shade number from 1.7 to 3.0 is recommended, but a darker shade may be required if spots appear in front of one's eyes after looking away from the kiln.

Do not use lead compounds at stoneware temperatures since the lead will vaporize.

Lumber, paper, solvents, or other combustible and flammable materials should not be stored in kiln areas.

Always check that the kiln has shut off.

If gas leaks are suspected (e.g. gas odor): shut off gas at the source; shut off power to the kiln room at the circuit breaker; and call Security (x2568).

HAZARDS

Chlorine, fluorine, sulfur dioxide, nitrogen dioxide, and ozone are highly toxic by inhalation. Bisque firings of high-sulfur clay have caused the production of great amounts of choking sulfur dioxide. Other large acute exposures to gases are not common. Inhalation of large amounts of these gases can result in severe acute or chronic lung problems. Long-term inhalation of low levels of these gases can cause chronic bronchitis and emphysema. Fluorine gas can also cause bone and teeth problems.

Many metal fumes generated at high temperatures are highly toxic by inhalation. Since lead vaporizes at a relatively low temperature, it is especially hazardous.

Carbon monoxide from fuel-fired kilns or the combustion of organic matter in clays is highly toxic by inhalation and can cause oxygen starvation. One symptom of carbon monoxide poisoning is an intense frontal headache, unrelievable by analgesics.

Hot kilns produce infrared radiation, which is hazardous to the eyes. There have been reports of cataracts, from years of looking inside the hot kilns.

Heat generated by the kiln can cause thermal burns.

Heat produced by even small electric kilns can cause fires in the presence of combustible materials or flammable liquids.

If an electric kiln fails to shut off, the heating elements melt which can cause fires. Gas kilns also generate a lot of heat, and room temperatures often exceed 100 °F.

While most glaze firings refer to firing a glaze-coated pot in the kiln, special processes sometimes are used. Salt glazing and raku firing are two examples.

SALT GLAZING

This process involves throwing wet salt (sodium chloride) into the heated kiln while the bisque ware is being fired. Wet salt at high temperatures decomposed to sodium and chlorine. The sodium reacts with the bisque ware to form a glaze. Large amounts of hydrogen chloride gas and possibly chlorine are also formed.

Sodium carbonate (washing soda) can also be used. Carbon dioxide is generated instead of hydrogen chloride.

PRECAUTIONS

Substitute safer sodium carbonate for sodium chloride.

Sodium chloride salt glazing should only be done outdoors. Kilns should be equipped with canopy hoods and chimney stacks that are tall enough to disperse the hydrogen chloride safely.

All gas piping, and metal fixtures should be routinely checked for corrosion.

HAZARDS

Hydrogen chloride gas is highly toxic by inhalation. Health effects are both similar and more irritating compared with most other kiln gases. Often, local environmental protection laws ban salt kilns.

Hydrogen chloride and water vapor form hydrochloric acid, which can corrode metal fittings in the area.

RAKU FIRING

Raku involves first firing ware at a low temperature in a regular gas kiln, and then removing the still hot pieces and placing in them in sawdust, leaves or other organic materials for a reduction phase.

PRECAUTIONS

Raku should only be done outdoors because of smoke. Be careful to not locate raku near air intakes or open windows of buildings.

Do not use materials that have been treated with preservatives or pesticides for the reduction phase.

HAZARDS

See above for the hazards and safety precautions used with gas kilns.

The reduction step produces large amounts of smoke and carbon monoxide.

Treated wood or other materials can yield an exposure to highly toxic preservatives or pesticides, such as arsenic and chromium compounds.

LEACHING

There is a real concern about lead leaching into food and drink from pottery fired with lead glazes. Both the US Food and Drug Administration (FDA) and the Canadian Consumer and Corporate Affairs have regulated how much lead can leach from food ware into food and drink. Acidic liquids are of particular concern. Similarly, continual microwave reheating, (e.g. a coffee mug at work) can yield greater leaching of lead glazes. Many cases of lead poisoning, and even some fatalities, have occurred from the leaching of lead from lead-glazed pottery.

While commercial ceramics companies routinely test their ware for lead leaching, craft potters do not have the same quality control as does the ceramics industry, and lead leaching is more of a problem.

According to United States regulation, ceramic ware that does not pass the lead leaching tests must have a permanent fired decal stating:

NOT FOR FOOD USE - MAY POISON
FOR DECORATIVE PURPOSES ONLY

A hole can be drilled in the pottery so it cannot be used for liquids or food.

Preferably, do not use lead glazes, especially for food and drink vessels. Any food ware produced by HACC for retail finished with lead glazes will be tested regularly by certified laboratories.

Other metals can leach into food and drink:

Cadmium is the single metal besides lead presently regulated in the United States and Canada. However, other possible toxic metals in glazes can leach.

Barium has been seen in some tests to leach in hazardous amounts from certain glaze formulations. If a barium glaze, or other glaze, changes color from contact with food, do not use the vessel for food. Try and use only glazes with calcium, magnesium, potassium, and sodium fluxes and minimize the amounts of toxic metal colorants. Routine testing for other metal leaching should be done.

Other Resources

The Artist's Complete Health and Safety Guide, Monona Rossol, Allworth Press, NY (available in the studio and the McCormick Library)

Artist Beware, Michael McCann, The Lyons Press, NY (Available in the studio and the McCormick Library)

Health Hazards Manual for Artists, Michael McCann, The Lyons Press, NY (available in McCormick Library) and online at http://www.uic.edu/sph/glakes/harts/HARTS_library/index.htm

Making Art Safely, Merle Sanforfer, Deborah Curtiss and Jack Snyder, Van Nostrand Reinhold, NY (available in McCormick Library)

New Jersey Department of Health website provides organized lists on hazardous substances, similar to MSDS, possibly easier to understand - http://nj.gov/health/eoh/rtkweb/index.shtml

EHS/KB 7/2011
EHS/KB 1/2012