Oddy Test Protocol at the Metropolitan Museum of Art (The Met)

Current Version: 20170606_OT and former version 20160416_OT

27 September 2017

Buscarino, I. C., Stephens, C. H., and Breitung, E. M.

This method adopts aspects from the protocol published by The British Museum, where test tubes are fitted with silicone stoppers holding three metal coupons, and the Met's original three in one jar version, where metals are hung from the rim of a beaker inside of a screw-top jar. In both cases, the corrosion states of the coupons after 28 days of aging at elevated temperatures and humidity in the presence of an unknown material are used to determine the appropriateness of a material for use in close proximity to cultural heritage materials.

The Met's test has been modified to improve the consistency of the test, and this document includes written instructions and links to video demonstrations of the method. Each change has been labeled as a new version of the test. A list of versions will be added to this document in the near future to correlate to results being published on the AIC Oddy Test Wiki site.

Outline:

I. Personal Protection Equipment (PPE)

II. Washing Methods

III. Metal Coupon Preparation

IV. Jar preparation and assembly

V. Assessment at completion of testing

VI. Materials and Supplies

VII. Photos of Scored Coupons

[1] Korenberg, C., Keable, M., Phippard, J., Doyle, A. "Refinents Introduced in the Oddy Test Methodology", Studies in Conservation, (August 2017), online article, 1-12.

[2] Bamberger, J. A., Howe, E. G., Wheeler, G., A Variant Oddy Test Procedure for Evaluating Materials Used in Storage and Display Cases, *Studies in Conservation* 44 (1999) 86-90.

I. Personal Protection Equipment (PPE): Nitrile gloves, safety glasses, and a laboratory coat are worn throughout this procedure. Hands are washed with soap and warm water prior to donning gloves to remove oils.[3] Care is taken to always handle the metal coupons (copper [Cu], lead [Pb], or silver [Ag]) with tweezers while wearing clean nitrile gloves, as handling coupons with dirty or oily hands can cause coupon contamination. Out of a small range of gloves, Freeform® SE blue powder-free nitrile gloves performed best in the Met's Oddy test and are worn throughout the procedure.

II. Washing Methods: Outlined below are two different washing methods. The hand washing method was used April 2016 to July 2017. The dishwasher method began in July 2017 and is our current washing method.

A) Dishwasher Method Used June 6, 2017-current (method 20170606_OT)
Using Lancer 815 LX Dishwasher

Glassware: Mechanically remove all materials from jar. Place each jar over a spindle jet. The wash cycle includes the following steps:

Prewash	Rinse for 2 min.* with 60°C water
Wash (base)	Rinse with 96 mL of NaOH in 12 L of water at 40°C for 2 min.*
Rinse A	Rinse for 2 min. with unheated water.
Acid Rinse	Rinse with 96 mL of Phosphoric Acid in 12 L of unheated water for 2 min.
Rinse B	Rinse for 3 min. with unheated water.
Rinse C	Rinse for 3 min. with unheated water.
Purified Water Rinse A	Rinse for 3 min. with unheated 15 MΩ-deionized water.
Purified Water Rinse B	Rinse for 1 min.* with 60°C 15 MΩ-deionized water.

*When water is being heated, it is recycled within the chamber until it reaches temperature, so the times listed are much shorter than the actual cycle time. After the washer reaches the prescribed temperature, it runs for the programmed amount of time. Detergents are not currently used, however, testing is underway to determine if their use improves consistency of results.

Washed glassware placed in a 60°C oven for drying and storage.

O-ring, lids, and silicone stoppers: Place on flat stainless steel mesh rack. Lids are placed upright and are weighted with a stainless steel mesh screen to inhibit flipping. The wash cycle includes the following steps:

Prewash	Rinse for 2 min.* with 80°C water
Rinse A	Rinse for 5 min. with unheated water.
Rinse B	Rinse for 1 min.* with 80°C water.
Purified Water Rinse A	Rinse for 1 min. with unheated 15 MΩ-deionized water.
Purified Water Rinse B	Rinse for 1 min.* with 60°C 15 MΩ-deionized water.

*When water is being heated, it is recycled within the chamber until it reaches temperature, so the times listed are much shorter than the actual cycle time. After the washer reaches the prescribed temperature, it runs for the programmed amount of time. Detergents are not currently used, however, testing is underway to determine if their use improves consistency of results.

Washed o-rings, lids, and silicone stoppers are dried and stored in a 60°C oven.

Vials: KIMAX™ vials are washed by hand.

1. Dirty vials are placed in a 50 mL Pyrex® beaker, and a disposable glass pipet is used to deliver solutions into the vials. Soak vials with Micro 90 Lab cleaner for at least 24 hours (1% solution in tap water). Rinse 3 times with tap water. Soak in room temperature aqueous sodium hydroxide (NaOH) bath with a pH of 12 for at least 15 hours (overnight). Use 10" stainless steel tongs for delivering and retrieving items from the baths. Thick nitrile gloves, safety glasses, and a laboratory coat are required.

a. **Base bath preparation (yields 1 L)**: Add 0.40 g NaOH (s) to 1 L of deionized H_2O. Check that the pH reads 12 on the pH indicator strip. The base bath is in a glass beaker contained in a lidded polypropylene 12 quart container within a secondary polypropylene drip container.

2. Rinse with hot tap water then place in a hydrochloric acid (HCl) bath with a pH of 2 for at least 15 hours (overnight). Thick nitrile gloves, safety glasses, and a laboratory coat are required.
    a. **Acid bath preparation (yields 1 L)**: Slowly add 0.8 mL HCl (37% w/w; 1.2 g/mL density) to 250 mL of deionized H_2O. Add the remaining 750 mL of deionized H_2O. Check that the pH reads 2 on the pH indicator strip. The acid bath is in a glass beaker contained in a lidded polypropylene 12 quart container within a secondary polypropylene drip container.

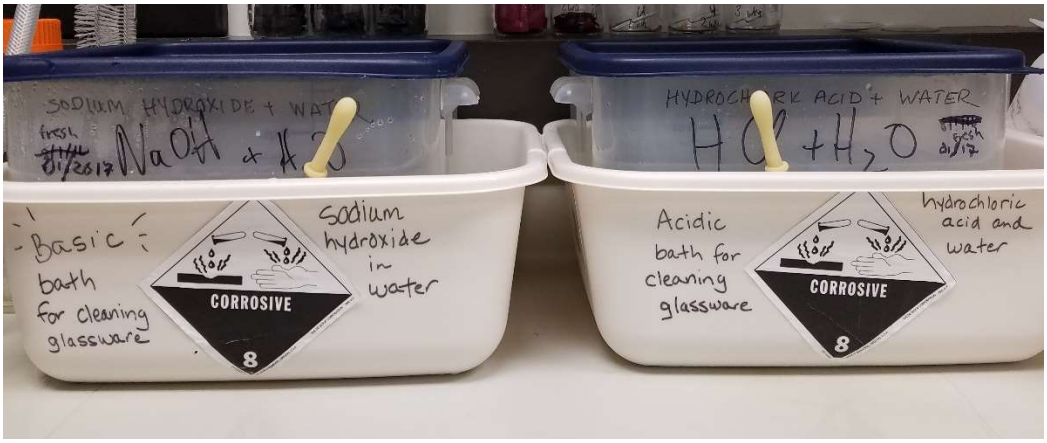


Figure 1: Base and acid baths in secondary containers.

b. Rinse three times with hot tap water then rinse three times with 18.2 mΩ-deionized water.
c. Dry in an oven, right side up, at 60°C.

B) Hand-washing Method Used April 2016-May 2017 (method 20160416_OT)

Glassware Preparation:

1. Wash with Micro-90 Lab Cleaner (1% solution in tap water) using a laboratory cleaning brush and tap water.
2. Rinse 3 times with hot tap water.
3. Soak in room temperature aqueous sodium hydroxide (NaOH) bath with a pH of 12 for at least 15 hours (overnight). Use pipets to deliver the solutions into the small vials. Use 10" stainless steel tongs for delivering and retrieving items from the baths. Thick nitrile gloves, safety glasses, and a laboratory coat are required.
    a. **Base bath preparation (yields 7 L)**: Add 3.0 g NaOH (s) to 7.5 L of deionized H_2O. Check that the pH reads 12 on the pH indicator strip. The base bath is contained in a lidded polypropylene 12 quart container within a secondary polypropylene drip container.
4. Rinse with hot tap water then placed in a hydrochloric acid (HCl) bath with a pH of 2 for at least 15 hours (overnight). Thick nitrile gloves, safety glasses, and a laboratory coat are required.

a. **Acid bath preparation (yields 7 L)**: Slowly add ~6 mL HCl (37% w/w; 1.2 g/mL density) to 2 L of deionized H_2O. Add the remaining 5 L of deionized H_2O. Check that the pH reads 2 on the pH indicator strip. The acid bath is contained in a lidded polypropylene 12 quart container within a secondary polypropylene drip container.

5. Rinse three times with hot tap water then rinse three times with 18.2 mΩ-deionized water
6. Dry in an oven, right side up, at 60°C.

O-ring, lids, and silicone stoppers:

1. Wash lids, silicone o-rings, and silicone stoppers in a Micro-90 Lab Cleaner solution (1% in tap water) by dipping in cleaning solution and rubbing with gloved hands or a clean sponge. Do NOT soak for any length of time in Micro-90 Lab Cleaner solution.
2. Rinse 3 times with hot tap water and 3 times with 18.2 MΩ-deionized water, making sure to rinse the slits in the bottom of the stopper thoroughly.
3. Store in oven at 60°C.

KIMAX™ Vials: Same as instructions outlined in the dishwashing method section II-A above.

III. Metal Coupon Preparation

1. Measure and cut high purity (99.998% or higher) metals (Ag, Pb, and Cu) into coupons measuring 0.8 cm x 2.5 cm.
    a. Use a dedicated pair of scissors for each metal.
2. Place a 12" x 12" flat glass plate inside the filtration box. Sand both sides of the lead coupon (Click here for video), sanding only along the length of the coupon, away from the user, using an unused area of folded 3200 grit Micromesh™ sand paper using even, light pressure. Each side of the long strip of lead should take approximately 35 seconds to sand. Anything longer tends to result in over-sanding. Consistent sanding is critical for producing reproducible test coupons. The idea is to remove the native oxide with minimal pressure. Printing and hanging enlarged images of over-sanded and correctly sanded lead coupons in the preparation area is recommended for reference. See Figure 2 below for an example of properly sanded lead and shiny over-sanded lead. The sanding process is completed in a hood with ULPA filtration (Click here for video).
    a. Sand lead coupons immediately before inserting into jars to minimize re-oxidation of the surface.

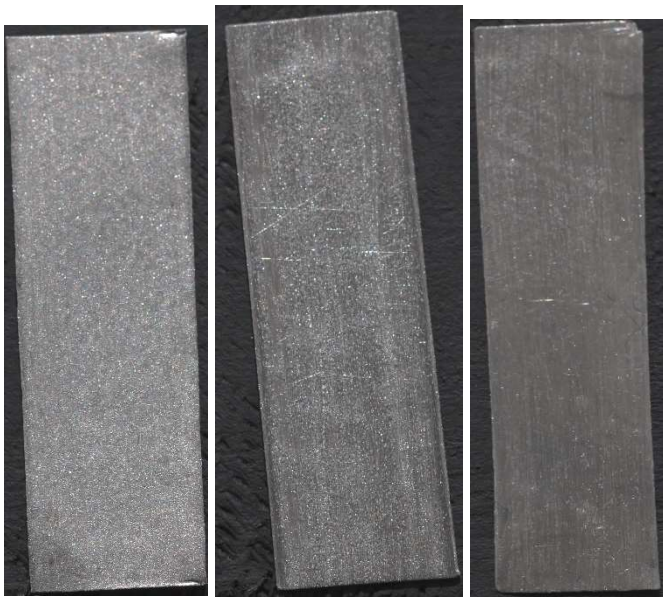


Figure 2: Left: a properly sanded lead coupon. Middle: a partially over-sanded lead coupon. Right: a completely over-sanded shiny lead coupon.

3. Soak copper and silver coupons in a small beaker of acetone and wipe dry with a Kimwipe®. Next, soak the coupons in fresh HPLC grade isopropanol. Remove from beaker and gently blot with a Kimwipe®. Collect rinse solutions and disposed of as hazardous waste. (Click here for video).
4. After sanding 0.8 cm x 10 cm lead strips, rinse each side with acetone from a wash bottle and gently wipe with a Kimwipe®. Repeat. Next dip a Kimwipe® in isopropanol and wipe each side of the lead strip. Repeat. (Click here for video).
5. After polishing and rinsing, dispose of Mylar, Pb-contaminated gloves, and sandpaper as lead-contaminated hazardous waste.
6. All metals are stored immediately upon receipt from the supplier in at least one Intercept® zip-loc™ style bag. Ideally both sides of the bag are composed of the Intercept material rather than using the style with a transparent window.

IV. Jar preparation and assembly

1. Run all tests in duplicate, including controls. Produce one set of controls for each group of tests. In other words, if 15 materials are being tested on Monday, one set of controls is required. A new set of controls is required for the next group of Oddy tests that are prepared on Tuesday.
2. To prepare one jar, place a sheet of weighing paper on the scale and tare to zero. Weigh 2g of test sample material on the paper and load into a 100 mL borosilicate jar (Kimble™ KIMAX™ GL 45 Media/Storage Bottles, Product # 02-542A, 100mL) along with a borosilicate mini-test tube (Kimble™ KIMAX™ Reusable Borosilicate Glass Tubes with Plain End, Product #14-925B, 0.7mL) containing 0.5mL 18.2 MΩ-deionized water. Dose 18.2 MΩ water into the mini-test tube using a recently calibrated micropipette.
    a. See Section VIII for a sample preparation guide.
    b. Each control jar contains 0.5 mL of water in the KIMAX™ test tube as well as the metal coupons inserted into a stopper. No other material is placed in the jar.

3. To a pre-washed new platinum-cured silicone #6 stopper, incise three slits (approximately 1 cm deep in a triangle formation, Figure 3) (click here for video). Fill each slit with one of the three metal coupons. Insert the stopper into the mouth of the jar.
    a. Make sure coupons do not contact each other, the jar, or test material.

Figure 3: Left: The template and scalpel used for incising the stopper. Right: actual size of the template.

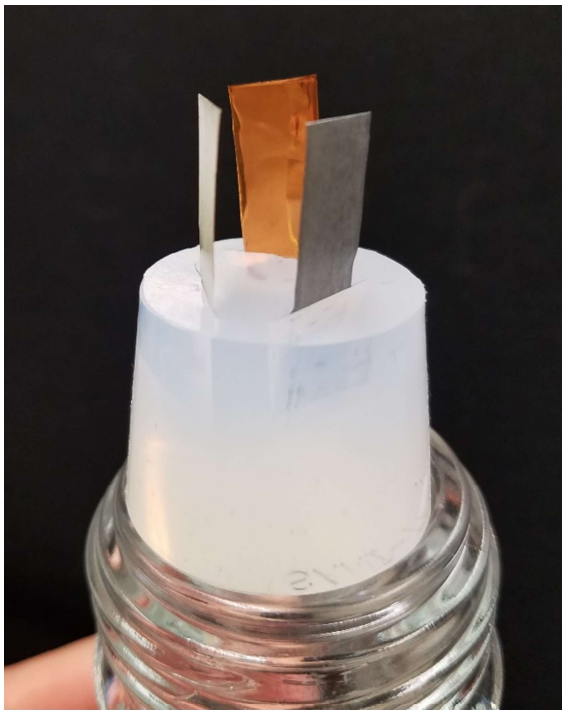


Figure 4: Triangular formation of coupons.

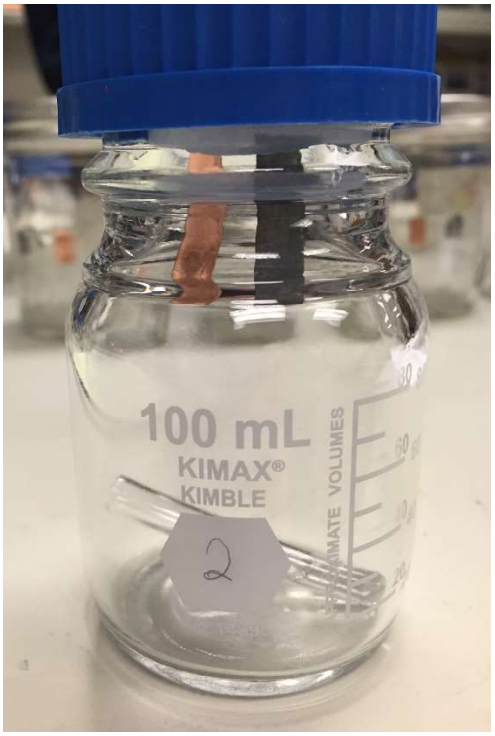


Figure 5: Sealed 'control' jar with coupons

4. Weigh jars and record values.
5. Place in oven leaving as much space between jars as possible for air circulation, standing upright.

Figure 6 & 7: Custom torque wrench socket produced to fit GL45 cap and CDI 1502MRMH-QR torque wrench (2.8-16.4 Nm range) used for tightening lids consistently.

6. Leave jars in oven at 60°C for 60 minutes. Remove jars and re-tighten lids to a torque of 4 Nm while warm using a torque wrench fitted with the custom socket.
7. Return jars to the oven and age at 60 ± 1.5 °C for 28 days.

V. Assessment at completion of testing

1. After 28 days in the oven, remove jars and allow to cool to room temperature.
2. Record weights of each jar. Compare to the pre-aged weights to determine whether each vessel was sealed during the experiment. A loss greater than 25% of mass (25% of 0.5 grams, or a loss of more than 0.13 grams) is considered a system failure, and the experiment is repeated.
3. Open jars and carefully remove stoppers with the aid of a small scoopula (click here for video)
4. Scribe the inside of each coupon (click here for video) where it meets the stopper with a dissection needle. Remove metal coupons from the stopper with tweezers and place on a piece of white paper (click here for video). Removal is sometimes easier if the stopper is squeezed to cause the slit of interest to open slightly.
5. Inscribe the letter "C" in the portion of the control coupons that were inserted into the stopper. Assess the controls for corrosion. If they are minimally corroded, proceed. If the coupon corrosion of a given metal in one jar is significantly different from that in the other or if there is significant corrosion, repeat the experiment.
6. Using a spatula, remove the o-ring from the lid. Dispose of stoppers from "temporary"/"unsuitable" test jars. Save and wash stoppers from "permanent" test jars.

Lead

Figure 8 & 9: Left: acceptable amount of minimal corrosion for control. Right: too much corrosion for control.

Copper

Figure 9 & 10: Left: acceptable amount of minimal corrosion for control. Right: too much corrosion for control.

Silver

Figure 10 & 11: Left: acceptable amount of minimal corrosion for control. Right: too much corrosion for control.

7. The following ratings are used to asses non-control coupons:
    a. "Permanent" rating: The material tested may be used indefinitely in the presence of art.
        i. Coupons look similar to the controls.
    b. "Temporary" rating: The material is safe for use near but not in contact with art for up to six months.
        i. Copper: slight reddening, yellowing, or rainbow-like color change, formation of up to 20 black spots
        ii. Silver: white splotches, slight yellowing, or purpling
        iii. Lead: darkening, yellow/olive tarnish, haze from slight crystal formation over the entire coupon, or heavier crystal formation at the interface with the stopper.
    c. "Unsuitable" rating: the material should not be used in contact with or near art and another material should be found.
        i. Copper: severe blackening or severe reddening or matte-textured surface.
        ii. Silver: severe color change to dark purple, yellow, or black; or a uniform white film.
        iii. Lead: white fluffy crystal formation.
8. See photos of scored coupons from permanent, temporary, and unsuitable categories in the appendix.

VI. Materials and Supplies

- Deionized H_2O (18.2 MΩ) (Millipore Simplicity Water Purification System with SimPak 2 Purification Pack)
- Freeform® SE blue powder-free examination gloves (Microflex Product FFS-700-S)
    - https://microflexpublic-ansellhealthcare.msappproxy.net/Products/FFS-700.aspx
- Micro-90 Concentrated Lab Cleaner Detergent (Sigma Product # Z281506-1EA)
    - http://www.sigmaaldrich.com/catalog/product/aldrich/z281506?lang=en&region=US
- Shapeways laser sintered nylon coupon holder
    - https://www.shapeways.com/product/62958LYNJ/oddy-test-hanger-triangular?optionId=64267957
- QUARK ENTERPRISES INC SILICONE O-RING GL45 12/PK (Fisher Product #NC0633697) (Size 2-323)
    - https://www.fishersci.com/shop/products/silicone-o-ring-gl45-12-pk/nc0633697?searchHijack=true&searchTerm=NC0633697&searchType=RAPID
- Kimble™ KIMAX™ GL 45 Media/Storage Bottles (Product # 02-542A) 100mL
- https://www.fishersci.com/shop/products/kimax-gl-45-media-storage-bottles-15/02542a Extra caps: Kimble™ Blue Polypropylene Cap (Product # 02-542-1)
    - https://www.fishersci.com/shop/products/kimble-blue-polypropylene-cap/025421#?keyword=14395c45
- STI Components #6 Stopper Solid Platinum-Cured Silicone Bottle Stoppers (Product #4120-006)
    - http://www.stiflow.com/silicone_fab_stoppers.htm
- Kimble™ KIMAX™ Reusable Borosilicate Glass Tubes with Plain End (Product #14-925B) 0.7mL
    - https://www.fishersci.com/shop/products/kimble-kimax-reusable-borosilicate-glass-tubes-plain-end-17/14925b?searchHijack=true&searchTerm=14925B&searchType=RAPID
- Spatula & Packer Double Ended - SurgicalExcel 81-12191
    - https://www.amazon.com/gp/product/B00HMI3PSM/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1
- Custom torque wrench socket produced to fit GL45 cap, if there is demand, we may be able to produce a 3D scan for printing from metal.
- CDI 1502MRMH-QR torque wrench (2.8-16.4 Nm range)
- Accupet 500-5000 ul Micropipette (Product #AP-5000)5 mL bulk Eppendorf-fit reference tips
    - http://ssibio.com/tips/specialty-tips/macro-volume-tips/4420-00-detail
- MYLAR® A 1 mil (25 micron)
    - http://www.tekra.com/products/films/polyester-films/polyester-pet/mylar
- EMD Millipore 109535 MColorpHast™ pH-indicator strips (non-bleeding), pH 0-14
    - https://www.emdmillipore.com/US/en/product/Papel-pH-1-14%2C0-pH-caixa-com-100-tiras%2C-menor-divis%C3%A3o-1%2C0,MDA_CHEM-109535
- 10” Stainless Steel Tongs
    - https://www.amazon.com/Surgical-Stainless-Steel-Tongs-Inch/dp/B0015AK5JK
- Surgical Scalpel with Fitment No. 3
    - http://www.swann-morton.com/product/122.php
- Disposable No. 11 surgical blades
    - http://www.swann-morton.com/product/18.php
- Wooden handled straight point teasing needle, Part Number: 19010

    - https://www.fishersci.com/shop/products/shandon-straight-point-teasing-needles/19010#
- Lancer 815 LX Dishwasher
    - http://www.lancer.com/Products/Laboratory/Glassware-Washer-Dryers/-Lancer-Undercounter-Laboratory-Washers/815LXOverview
- LancerClean Sodium Hydroxide (NaOH) Detergent – LCD-S
    - http://www.lancer.com/Products/Consumables/Cleaning-Chemicals/LancerCleanDetergent#5574-product-features
- LancerAcid Phosphoric Acid Rinse – LCA-P
    - http://www.lancer.com/Products/Consumables/Cleaning-Chemicals/LancerAcidRinse

Metal Preparation Material

- Micro Mesh Regular 3200
    - http://micro-surface.com/index.php/products-by-type/rolls/micro-mesh-rolls.html
- Acetone HPLC grade
    - https://www.fishersci.com/shop/products/acetone-hplc-fisher-chemical-6/p-215618
- Isopropanol HPLC grade
    - https://www.fishersci.com/shop/products/isopropanol-99-9-hplc-grade-fisher-bioreagents/bp26324#?keyword=isopropanol+%28hplc%29
- Metal Coupons (Purity) - Alfa Aesar (Pb) and Fine Metals Corp. (Ag & Cu)
    - Pb : Alfa Aesar™ Lead foil, 0.1mm (0.004 in.) thick, Puratronic™, 99.998% (metals basis)
        - https://www.fishersci.com/shop/products/lead-foil-0-1mm-0-004-in-thick-puratronic-99-998-metals-basis-2/aa12051gh?searchHijack=true&searchTerm=AA12051GH&searchType=RAPID
    - Ag : Silver foil, 99.99999% (metals basis), annealed, 0.1 mm x 100 mm x 100 mm; Fine Metals Corporation
        - http://www.finemetalscorp.com/View.aspx?page=metals/silver/silverfoil
    - Cu : Copper foil, 99.99999% (metals basis), annealed, 0.1 mm x 100 mm x 100 mm; Fine Metals Corporation
        - http://www.finemetalscorp.com/View.aspx?page=metals/copper/copperfoil

VII. Photos of Scored Coupons

Permanent

LEAD

COPPER

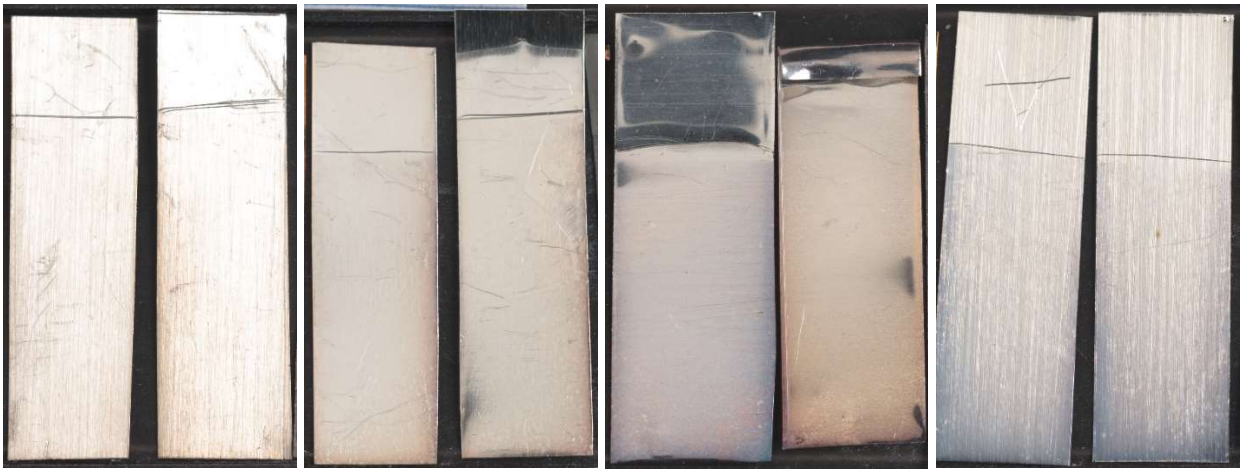
Silver

Temporary

LEAD

COPPER

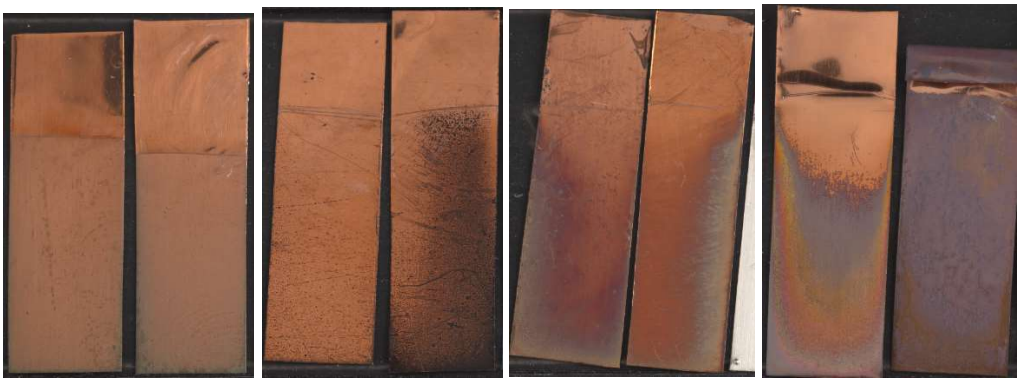
SILVER



Unsuitable

LEAD

COPPER



SILVER

VII. Oddy Test Material Sample Preparation Guide

Material	Proposed Cutting Method
Board - composite (eg. Corian, drywall)	Cut with universal blade band saw into 0.5" cubes. Use utility knife to produce smaller pieces to make 2.0g.
Board - natural (eg. wood, cotton)	Cut with universal blade band saw into 0.5" cubes. Use utility knife to produce smaller pieces to make 2.0g.
Board - plastic/polymeric/synthetic	Cut with universal blade band saw into 0.5" cubes. Use utility knife to produce smaller pieces to make 2.0g.
Carpet - natural/non-syntheticfiber	Cut with scissors or utility knife into 1 x 1" squares. To reach 2.0 g, cut pieces that represent the sample's composition—example: the correct ratio of carpet material, blended fibers in carpet, and base of carpet.
Carpet - plastic/polymeric/synthetic fiber	Cut with clean scissors or utility knife into 1 x 1" squares. To reach 2.0 g, cut pieces that represent the sample's composition—example: the correct ratio of carpet material, blended fibers in carpet, and base of carpet.
Coating - floor (e.g. stain, anti-wear, anti-slip)	Follow manufacturer's instructions regarding dilution; if to be used dry, paint out on Mylar® and cure per manufacturer's guidelines; if to be used wet, use 0.5mL of liquid in lieu of water.
Coating - grease, oil, wax	Into a 5mL beaker, weigh 2.0 g of sample. Carefully place into the sample jar. Other borosilicate vessels that fit are acceptable as long as they are no more than 4cm tall.
Coating - paint & primer	Paint material onto a Mylar® sheet and spread to a thickness that reflects how it will be used in the museum. Cure the material according to manufacturer's instructions. After curing, cut the painted Mylar® into 1.5" wide strips and weigh to 2.0 g, taking the weight of the Mylar® into account by subtracting it from the total sample weight. Put a small piece of Mylar® at the bottom of the jar if there's concern about the material sticking to the glass. Roll the sample strips into a coil with the sample material facing inward, and place in the bottom of the jar.
Coating - protective (e.g. anti-UV, -abrasion, -tarnish)	Paint the material onto a Mylar® sheet and spread to a thickness that reflects how it will be used in the museum. Cure the material according to manufacturer's instructions. After curing, cut the painted Mylar® into 1.5" wide strips and weigh to 2.0 g, taking the weight of the Mylar® into account by

	subtracting it from the total sample weight. Put a small piece of Mylar® at the bottom of the jar if there's concern about the material sticking to the glass. Roll the sample strips into a coil with the sample material facing inward, and place in the bottom of the jar.
Fabric - batting & padding	Cut material with clean fabric scissors into 1 x 1" squares. To reach 2.0 g, cut small segments from a 1" square.
Fabric - book cloth	Cut material with clean fabric scissors into 1 x 1" squares. To reach 2.0 g, cut small segments from a 1" square.
Fabric - exhibition/woven	Cut material with fabric scissors into 1 x 1" squares. To reach 2.0 g, cut small segments from a 1" square.
Fiber or Thread	Cut the length of sample that weighs 2.0 g. Wind it loosely and neatly around two gloved fingers, remove, and place in the bottom of the sample jar.
Inorganic - (e.g. fillers, salts, rocks)	Keep the sample as is or prepare it as it would be used in the museum. For example, if you are testing salts, do not grind them further unless that's how they are used in the museum setting. Weight 2.0 g of sample.
Metal - mechanical fastener	Place whole fastener in jar.
Paper-based (e.g. folder, cardboard, sheet)	Cut material with clean scissors into 1 x 1" squares. To reach 2.0 g, cut pieces from a 1" square.
Paper-based, Filled (e.g. fillers such as silica gel, zeolites, alumina)	Cut material with clean scissors into 1 x 1" squares. To reach 2.0 g, cut pieces from a 1" square.
Paste - filler/binder mixture (e.g. plaster, acrylic spackle, non-paint)	Extrude onto a Mylar® sheet. Spread to a thickness that reflects how it will be used in the museum setting. Cure material per manufacturer's suggestion. After cured, peel the material from the Mylar® if possible and weigh to 2.0 g. If the material cannot be freed from the Mylar®, remove excess Mylar® and weigh the material to 2.00 g, taking the weight of the Mylar® into account by subtracting it from the total sample weight.
Polymer - adhesive - caulk or sealant	Extrude onto a Mylar® sheet. Spread a thickness that reflects how it will be used in the museum setting. Cure per manufacturer's instructions. After curing, peel the material from the Mylar® if possible and weigh to 2.0 g. If the material cannot be freed from the Mylar®, remove excess Mylar® and weigh the material to 2.0 g, taking the weight of the

	Mylar® into account by subtracting it from the total sample weight.
Polymer - adhesive - glues - liquid (e.g. acrylics, wood glues, starches)	Extrude adhesives onto Mylar® sheeting in a thickness that reflects the actual material application thickness. Cure per manufacturer's instructions. Cut the sample into 1 x 1" squares. Weigh the dried material on Mylar®, taking into account the weight of the Mylar® attached to the sample. To reach 2.0 g, cut pieces from a 1 x 1" square.
Polymer - adhesive - heat activated (e.g. hot melt, heat set)	Extrude 2" strips of melted material onto aluminum foil. Allow to cool. Peel from aluminum foil and weigh out 2.0 g of sample. If material does not remove from foil, repeat on Mylar® and account for the weight of the Mylar® in weighing the sample.
Polymer - adhesive - pressure-sensitive	Cut 2" lengths of tape, taping the adhesive sides, to the backed sides to form a small 2.0 g block of tape. Place the sample onto Mylar® to protect the jar from the adhesive
Polymer - adhesive tape - double sided	Fold the tape onto itself "accordion style" every 2" while removing the backing. Put 2.00 g sample on a piece of Mylar® to protect the jar from the adhesive, and carefully place in the bottom of the jar.
Polymer - adhesive tape - single sided	Cut 2" lengths of tape, taping the adhesive sides, to the backed sides to produce a small 2.0 g block of tape. Place the sample onto Mylar® to protect the jar from the adhesive
Polymer - block/bulk/pellet	If material comes in a block, cut into 0.5" cubes using a band-saw. If the material comes in small pellets that fit in the sample jar, use whole uncut pellets. To reach 2.0 g, shave material from one cube or pellet using a utility knife.
Polymer - foam - building insulation	For dense foam, cut with universal band saw into 0.5" cubes. To reach 2.0 g, remove material from one cube using a utility knife. For soft foams, cut material with clean scissors into a 1.5" wide strip that weighs 2.0 g. Compress the strip into a roll, and insert into the bottom of the jar. Make sure the foam does NOT touch the metal coupons when it expands.
Polymer - foam - non building insulation	For dense foam, cut with universal band saw into 0.5" cubes. To reach 2.0 g, shave any excess material on only one cube using a utility knife. For soft foams, cut material with scissors into a 1.5" wide strip that weighs 2.00 g. Compress

	the strip into a roll, and insert into the bottom of the jar. Make sure the foam does NOT touch the metal coupons when it expands.
Polymer - foam sealant	Cut material with clean scissors into a 1.5" wide strip that weighs 2.0 g. Compress the strip into a roll, and insert into the bottom of the jar. Make sure the foam does NOT touch the metal coupons when it expands.
Polymer - gasket	Cut material with clean scissors into 2" length strips.
Polymer - glove	Cut material with clean scissors into 1 x 1" squares. To reach 2.0 g, cut pieces from a 1" square.
Polymer - membrane (<1mm thick)	Cut material with clean scissors into 1 x 1" squares. To reach 2.0 g, cut pieces from a 1" square.
Polymer - sheet (>1mm thick)	Cut material with clean scissors into 1 x 1" squares. To reach 2.0 g, cut a minimal amount of strips from a 1" square.

Oddy Test Form

METROPOLITAN MUSEUM OF ART - *ODDY MATERIALS TESTING*

Department of Scientific Research/ Sherman Fairchild Center for Objects Conservation

Oddy Test Number

Date In

Name

Tester In

Dept

Date Out

Phone

Tester Out

Email

Exhibition/ Dept

Class of Material (polymer, fabric, etc)

Type of Material (polyethylene, cotton, etc)

Known Components (type of polymer, wood, additives, etc.)

Manufacturer (Supplier if unknown)

Make & Model (e.g. UltraV, #505)

Specifications (dimensions, prod. processes, etc.)

Results Cu

Weight in (g)A

Results Ag

Weight out (g)A

Results Pb

Weight in (g)B

Designation

Weight out (g)B

Metal Purity

MicroMesh grit

Red Silicone O-ring used

Amount of water used (ml)

Notes
