



Conserve O Gram

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Creating A Microclimate Box for Metal Storage

Introduction

Metal objects corrode and deteriorate when exposed to moisture and pollutants. Iron and copper alloy objects are especially vulnerable and can exhibit active corrosion reactions. These can develop rapidly and degrade an object. To slow the process of deterioration (*Museum Handbook* 4:14; O:4; 5), house metal objects below 35% relative humidity (RH). Metal objects, including those that are actively corroding, can be stabilized in a dry microclimate. This *Conserve O Gram* (COG) provides guidance on how to create a microclimate storage box.

A microenvironment is an enclosed space with an airtight seal that controls RH with desiccants such as silica gel (See “Using Silica Gel in Microenvironments,” COG 1/8) or montmorillonite clay. These remove excess RH from the enclosed space. A dry microenvironment can help stabilize actively corroding metals and protect metal objects from exposure to high RH. This storage solution also provides localized passive environmental control for all metal objects by reducing risk of exposure to RH spikes. Because it does not use complex mechanical systems, it is a low cost way to isolate metals in a dry climate within a larger environment. Microclimate boxes can be readily set up within a storage area that houses other materials with different RH requirements.

Note: Do not use a dry microclimate storage box for objects made of other materials such

as wood, glass and leather or composite objects that include metal.

Materials

- Polypropylene(PP) or Polyethylene (PE) storage container with silicon gasket
- Desiccant conditioned to 0-10% RH
- Humidity indicator that reads 0-15% RH
- pH neutral (archival) storage materials to support object (archival corrugated board, polyethylene foam, twill tape, zipper lock bags)

Procedures

Prepare objects for storage in the microclimate box:

- Bag small objects in zipper lock bags padded with polyethylene sheets.
- Place larger objects on a tray and secure with polyethylene foam bumpers or cotton twill tape ties. See Figure 1.



Figure 1. Metal objects prepared for storage in a tray and zipperlock bags.

Prepare the microclimate box:

- Select polypropylene or polyethylene container with silicon gaskets to accommodate the objects and desiccant containers.
- Add the humidity indicator card and position so the card can be read through the sidewall of the box.
- Prepare the appropriate quantity of desiccant for the size of the container. (See COG 1/8). See Table 1 for recommended quantities of desiccant.
- Pack silica gel in permeable boxes or in resealable fabric or Tyvek[®] bags. (Note that the Tyvek[®] bag itself cannot be reconditioned; the silica gel will need to be removed for reconditioning.) **Do not allow silica gel to come in direct contact with the objects.**
- Place desiccant containers along the side or on the bottom of the box.
- Place the object(s) in the box. Ensure all components are secure and do not fall onto each other when moved. See Figure 2 to see examples of components placed inside the box.



Figure 2. Microclimate box components; box, desiccant, and humidity indicator.

Maintenance

The polyethylene or polypropylene storage container with a silicon gasket is moisture permeable and humidity slowly leaks through the seal over time. The desiccant will absorb that moisture and regulate the environment for several years. However, the effectiveness drops with time. The amount of time is dependent on the amount of moisture present in the local climate. The humidity indicator card provides a visual signal that the RH has increased

Table 1. Recommended Quantities of Desiccant for Sample Container Sizes.

General Container Size	Volume	Quantity Recommended Regular Density Silica Gel * (18 kg/m ³ or 1.1 lb/ft ³)	Quantity Recommended Montmorillonite Clay (i.e. Desi -Pack*) (18 kg/m ³ or 1.1 lb/ft ³)	Quantity Recommended Rhapsid Gel* (4 kg/m ³ or 0.25 lb/ft ³)
4.75" x 11" x 4"	8.5 cups/2 liters/ 2.1 quarts = 122 in ³ or 0.07ft ³	1.5 ounces	1.5 ounces	0.4 ounces
9" x 11.5" x 3.5"	16.5 cups/3.9 liters/4.1 quarts = 237.9 in ³ or 0.14 ft ³	2.5 ounces	2.5 ounces	0.6 ounces
9" x 11.5" x 7.5"	38 cups/9 liters/ 9.5 quarts = 549 in ³ or 0.32 ft ³	5.5 ounces	5.5 ounces	1.3 ounces

*Silica gel amounts based on 'Demystifying Silica Gel' by Steve Weintraub.

**Examples of desiccant available in today's market, not recommendations of specific products.



Figure 3. Microclimate boxes partially filled with objects.

beyond the desired level (See COG 14/12, for more information on RH indicator cards). Monitor the microclimate environments on a quarterly basis. The desiccant may need to be reconditioned or replaced on an annual basis.

Selected Sources:

Polypropylene (PP) or Polyethylene (PE) storage container with silicon gasket: grocery stores, large discount stores, and online at stores

Desiccant conditioned to 0-10% RH: Silica Gel Packets. www.silicagelpackets.com

Montmorillonite clay: Desi-Pak units. Sphinx Adsorbents, Inc. www.sphinxadsorbents.com/desipak.1.htm

RHapid GEL: Art Preservation Services. www.apsnyc.com

Hydrosorbent Compact Unit
40 grams Silica Gel. Available through multiple suppliers

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Humidity Indicator Cards (5, 10, 15%):
ULINE. www.uline.com

Archival storage materials to support objects: archival corrugated board, polyethylene foam, twill tape, zipper lock bags: suppliers of library, museum and conservation materials.

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