4.4 Storage Enclosures for Books and Artifacts on Paper

Protective enclosures made of chemically stable materials provide both physical support and chemical protection for books and artifacts on paper. Materials from which enclosures are constructed should meet preservation standards since poor-quality materials can cause irreparable damage.

CHEMICAL STABILITY

Acids in paper are responsible for much of the deterioration suffered by books and artifacts on paper. This deterioration is most noticeable as discoloration and embrittlement. Examples include the following:

- Acidity in poor-quality folders can migrate into documents housed in the folders, discolor the documents, and hasten their deterioration. The same is true for envelopes and portfolios.
- Enclosures made from chemically unstable materials can deteriorate to the point of falling apart, threatening the physical safety of the items they are intended to protect.
- Acidic interleaving papers can transfer acids to the items they touch, leading to further damage.
- Discoloration from acidic window mats often referred to as "mat burn", disfigures works of art and damages the matted object in the area where it occurs. Similar damage results when items are framed with wood or corrugated ground wood backings, and slat burns or striations form in the work of art. Additionally, when mats become acidic, they become brittle. In advanced stages of deterioration they may be unable to support their own weight and may break. This in turn may tear or crease the work of art.

It is essential that storage enclosures be made of acid-free materials. Storage materials should be chemically stable so that they do not form acids over time.

Lignin, ground wood, and alum-rosin sizing are common components of paper that lead to the formation of acid, so it is important to choose storage materials that are free of these components. Use lignin-free and chemically purified board to construct protective enclosures.
For matting works of art on paper, use a 100 percent cotton rag board or a lignin-free, chemically purified conservation mounting board. All papers for interleaving sheets, folders, and envelopes should also meet these specifications. When making mats, folders, and boxes, use adhesives and tapes that are chemically stable, non-staining, and free of damaging components.

**ALKALINE BUFFER**

As added protection acid formation, paper-based storage materials may have a buffer, such as calcium carbonate, added during manufacture. The purpose of the buffer is to neutralize acids as they form in the storage materials. Suppliers of storage materials can provide information regarding the type and amount of alkaline buffer used. Many papers and conservation mounting boards contain 3 percent calcium carbonate. Buffered materials are appropriate for storing most books and artifacts on paper. Common exceptions include works of art that contain dyes or pigments sensitive to high alkalinity, collages with wool or silk components, blueprints, cyanotypes, diazotypes, and some types of photographs.

**MOLECULAR TRAPS OR SIEVES**

A recently developed storage material based on the combination of one or more alkaline buffers with a molecular trap, either activated carbon or zeolites, is intended to protect items better than storage materials that contain only an alkaline buffer. These storage materials provide protection against environmental pollutants and byproducts of deterioration not neutralized by alkaline buffers in the storage material. Although alkaline buffers neutralize free acids generated within the storage materials, research indicates that pollutant gases in the environment pass through the storage materials unaffected by the alkaline buffers, and that such gases can be captured by molecular sieves or zeolites. When used in a closed environment such as a sealed display case, molecular traps capture and remove the harmful molecules that pass by the alkaline buffer. Their efficacy in a more open system such as a document storage box is expected to be less. Results from an independent study conducted at the Library or Congress in 2005–2006, presented at the annual meeting of the American Institute for Conservation of Historic and Artistic Works, may be published shortly.

**pH**

The acidity and alkalinity of paper-based materials, including various types of board for storage boxes and mats, is expressed by pH, based on a logarithmic scale of zero through 14. Seven is the neutral point; measurements under seven are acidic and over seven are alkaline. Although there are differing recommendations for an ideal pH for storage, a pH of 7.0 through 8.5 is a good general guide for books and artifacts on paper. As stated above, care must be taken when choosing enclosures for media that are especially sensitive to high alkalinity. Moreover, a
primary criterion for choosing photograph enclosures is whether the enclosure has passed the Photographic Activity Test (PAT). See Care of Photographs for more details.

There are several methods for measuring pH. The simplest is a pH detector pencil or pen, which indicates the surface pH of the material tested. When using these pens, ideally one would test the core of papers and boards as well as the surface because a surface reading alone may not be accurate. These pens leave a disfiguring stain and should never be used to test an object. A more specific pH reading can be obtained by using pH indicator strips. pH meters provide the most accurate readings. When selecting storage materials, a pH reading above 7.0 does not necessarily mean that a material is of preservation quality. Some newly manufactured wood pulp board can be alkaline but becomes acidic rather quickly. Manufacturers should identify all the components of storage materials as well as provide information regarding the manufacturing process used. This information should be considered along with the pH when selecting materials for storage enclosures.

**DURABILITY**

Books and artifacts on paper should be stored only in enclosures of an appropriate durability. If enclosures are not sturdy enough to support artifacts adequately, the objects may become distorted, creased, or torn, or the storage enclosure itself may deteriorate over time. Overly strong storage enclosures may also add unnecessary weight and bulk that can lead to handling and space problems.

**ANSI STANDARDS**

The term *permanent* or *permanent durable* is sometimes used to describe materials that are chemically and physically stable. The *American National Standard for Permanence of Paper for Publications and Documents in Libraries and Archives*, ANSI/NIPO Z39.48-1992, approved by the American National Standards Institute and developed by the National Information Standards Organization, uses these terms. This standard establishes criteria for paper that will last for several hundred years under normal use and storage conditions. It is intended as a guide in the selection of papers for publications. It can also be used as a guide in selecting papers as storage materials.

PLASTICS

Plastics vary greatly in chemical stability and should be used with caution. Chemically unstable plastics produce by-products that accelerate the breakdown of paper as they deteriorate. Others contain volatile plasticizers that can cause items in contact with them to stick to their surface and media to bleed. Three types of plastic meet preservation standards: polypropylene, polyester, and polyethylene.

Polypropylene is frequently used for boxes and trays. Polyester film is used as an interleaving material to protect the surface of items, to make folders, and to encapsulate single items. Only polyesters free of plasticizers, ultraviolet inhibitors, dyes, and surface coatings are chemically stable. Polyester film has an electrostatic charge that can lift loosely bound media from the surface of paper. For this reason it should not be used for items with media that are not firmly bound to paper, such as pastel, chalk, charcoal, and soft graphite pencil. Flaking inks may also be adversely affected by the static electricity. Polyester film can be sealed by equipment that forms either an ultrasonic or a heat-activated weld. If the equipment required for this welding is not available, polyester sleeves can be purchased from conservation suppliers. Double-sided tape to seal polyester sleeves is not recommended as adhesives flow over time and can damage artifacts that the polyester is meant to protect.

SOURCE OF SUPPLIES

Preservation-quality storage enclosures are available from a number of suppliers. Obtain catalogs from several suppliers to compare costs and assess a full range of available products. If you have questions about the composition of a product, ask the supplier for details. This information should be readily available. If you require further assistance, contact the Field Service Department at the Northeast Document Conservation Center.

ACKNOWLEDGMENTS

This preservation leaflet is an update of the 1999 leaflet written by Sherelyn Ogden, Head of Conservation, Minnesota Historical Society.