NEDCC
NORTHEAST DOCUMENT CONSERVATION CENTER

REFORMATTING

6.1 Microfilm and Microfiche

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INTRODUCTION

Most collecting institutions still hold materials in microformats. While the most common are the familiar 16mm and 35mm roll microfilm and the flat, card-shaped microfiche, microforms come in a number of shapes, sizes, film bases, and film types. Other, less commonly found microformats include aperture cards (a paper-stock card with a single microfilm frame, usually 35mm, often used for archiving engineering drawings) and microcards (similar to fiche but printed on photographic paper rather than film).

Microfilm and fiche are manufactured on a variety of film bases and film types and so need special considerations for storage and handling. To help understand the needs of these materials, this leaflet will discuss:

- types of film found in collections
- necessary environmental conditions for preservation
- considerations for handling and equipment
- what to do in the event of a collections emergency or disaster

HISTORY

The concept of micro-photography was introduced in 1839 and was proposed as a document preservation technique in 1851. However, it was not until the era of flexible film that the idea caught on. Originally developed in the 1920s for use in banking, microfilm was embraced by libraries and other institutions: the Library of Congress began a major filming project in 1927. The era of newspaper filming began in 1935 when *The New York Times* started filming and publishing its print run. In the wake of these two considerable projects, cultural heritage organizations realized they could affordably film their collections not just for preservation, but also for access and distribution, much as digitization is used today.

FILM BASES

Through the years, microforms have been manufactured on various film bases, including cellulose nitrate, cellulose acetate, and polyester.

Cellulose nitrate-based microforms, like other cellulose nitrate films, are highly flammable, prone to releasing hazardous gases over time, and subject to natural decomposition. By the early 1950s, commercial production of all formats of cellulose nitrate film had permanently ceased.

Cellulose acetate film, also called safety film, is less flammable than nitrate but will still naturally degrade over time. This degradation process is called vinegar syndrome because of the familiar vinegar smell produced by the acetic acid as it off-gasses. Although a great deal of acetate microfilm exists, acetate film is not acceptable as a preservation medium for microforms.

Polyester is the only film base stable enough to be recommended for preservation microfilming. Black-and-white polyester film has a life expectancy of 500+ years under proper storage conditions.

For more information on microfilm bases, see NEDCC's Preservation Leaflet 5.1 "A Short Guide to Film Base Photographic Materials: Identification, Care, and Duplication" at https://www.nedcc.org/free-resources/preservation-leaflets/5.-photographs/5.1-a-short-guide-to-film-base-photographic-materials-identification,-care,-and-duplication.

FILM TYPES

Silver-Gelatin (or Silver-Halide)

Silver-gelatin films are the primary film type of a master film or fiche. Based on the familiar technology of black-and-white photography, this film is the only microform medium appropriate for archival purposes. The original (master) silver-gelatin microfilm is usually a negative image, but positive or negative duplicates can be produced. The emulsion side of this film is matte, while the non-emulsion side is glossy. Silver-gelatin film can be on nitrate, acetate, or polyester bases.

Diazo

Diazo films are used to create a service master, directly copying the master film through contact printing. Diazo films contain diazonium salts in the coating layer that combine with dye couplers to produce strong, dense colors available in a wide

range, including black. They may have an acetate or polyester base. Processed black diazo resembles silver gelatin film but is glossy on both sides. Diazo film is reasonably stable, but the dyes will eventually fade, even in darkened storage conditions. Fading is accelerated by prolonged exposure to light (such as in a film reader).

Vesicular

Vesicular films use an inexpensive process to create use copies of film and fiche. These films take advantage of the fact that diazonium salts produce nitrogen as they decompose when exposed to UV radiation. In vesicular films, diazonium salt coating is sandwiched between two base layers. The film is placed in direct contact with a master film, exposed, and developed by heating the film. As a result, the image will always exhibit slightly raised areas made of small bubbles.

The vesicular film base must be polyester because acetate cannot tolerate the heat used in processing. Mechanical pressure frequently causes damage to vesicular film, as pressure will collapse the bubbles. Another major vulnerability becomes apparent at high temperatures (such as those caused by heat-emitting viewing equipment or ambient air temperature) which cause the base material to soften, allowing the gas contained in the bubbles to expand. As the bubbles grow in size, they can rupture, leaving patches of clear film where the image was formerly visible. This is called bubble migration or movement.

Color

Though potential applications for color microforms are numerous, their use as a preservation strategy is limited because the life expectancy of most 35mm color films fall far short of preservation goals.

STORAGE ENVIRONMENTS

Temperature and Relative Humidity

In general, the environmental requirements of microforms resemble those of other photographic materials. Temperature should not exceed 70°F, and cooler temperatures are preferable. Year-round relative humidity lower than 50% is recommended for all film types. An upper limit of 40% is recommended for silver-gelatin films to minimize the likelihood of microscopic blemishes from silver oxidation (sometimes called "measles"). Black and white master films should be stored at 55°F, 50% RH with a recommended maximum of 70°F, 50% RH, ±5%.

Pollution

Particulate pollutants, also known as dust, are a source of scratches and abrasions on microfilm. Silver-gelatin films are particularly vulnerable to such damage. Cleaning of equipment and regular vacuuming is important in storage and use areas.

Gaseous air contaminants, such as oxides of sulfur and nitrogen, paint fumes, ammonia, peroxides, ozone, and formaldehyde, can damage film bases and emulsions. These contaminants may produce oxidizing or reducing effects that cause micro-blemishes on silver-gelatin films. Precautions must be taken to reduce the risk of exposure: microforms should not be stored near photocopiers, which can be a source of ozone. In addition, microforms should be removed from any area which is to be painted; fans should be used to provide good air circulation, and paint should be allowed to cure according to factory specifications before films are returned to the space. Wooden shelving or cabinets should not be used in areas where microform masters are stored because harmful acids and other damaging substances are emitted by wood, wood composites, and some sealants and adhesives.

Diazo, vesicular, and silver-gelatin films and fiche should not be rolled on the same spools, sleeved in the same enclosures, or stored in the same containers so as to prevent chemical interactions with each other. Space and access problems usually make separate cabinets for different film types impractical, but separate spools and fiche sleeves should always be used.

Nitrate and acetate films are a source of acidic deterioration products. They should be physically separated from other films and systematically replaced.

STORAGE ENCLOSURES

Closed steel cabinets—drawers, shelves, or racks—are most desirable for microfiche storage. Microfiche sleeves should fit snuggly into drawers but not be compressed in order to fit. If a drawer is not full, use spacers to prevent curling. Microfiche should be sleeved with the emulsion side *away* from the interior enclosure edges to prevent abrasion; this also adds protection from adhesives on the sealed edges.

Boxed films can be stored in drawers, cabinets, or on open shelves. Rolls of microfilm should be stored individually in boxes to prevent chemical interactions with each other and the environment. Microfilm boxes should pass the Photographic Activity Test (PAT). Paper enclosures should be acid-free, lignin-free, and buffered. Other options include sealed metal cans and chemically inert plastic containers (polyester, polyethylene, and polypropylene). If storing film in sealed cans, molecular sieves should be used with acetate to prevent increased degradation from off-gassed acetic acid. Microfilm reels should be held in the wound position by a preservation-quality paper tag secured with a string and button tie. Since rubber bands contain residual sulfur (a source of film and emulsion damage), they should never be used.

HANDLING OF FILM

Education of staff and users regarding the proper handling of microforms is essential for increasing the longevity of the film. Since acidic skin oils and fingerprints can damage film, master negatives should be handled as little as possible, and copies should be made available for researchers' use. All film and fiche should be handled by the edges or leaders. Only one microform at a time should be removed from its enclosure. Fiche should be re-sleeved immediately after use; film should be immediately

re-boxed. In addition, rolled film should never be pulled tight on the reel as this can cause abrasions.

If low temperatures are maintained for collection storage, and if viewing equipment is located outside of the storage areas, then a conditioning period is required to allow gradual warming of cold films before they are read. Rapid transfer from a cold to a warm space may cause damaging water condensation on the surface of the films.

EQUIPMENT

Equipment for reading, printing, and scanning microforms is available in a variety of formats. Used equipment can be purchased readily, and an internet search for "used microfilm equipment" will offer many options. However, due diligence is required to find the right equipment from the right vendor for your institution. Ask questions and request references for any large purchases. New equipment is also available and is often a combination of film and fiche reader/printer/scanner. Many offer the option of remote access. For vendors of new microform equipment, see the *American Libraries* Buyers Guide at http://americanlibrariesbuyersguide.com/. A useful checklist for choosing microform equipment can be found at http://rm.sc.gov/leaflets/Documents/NINE.pdf.

Equipment requires care and maintenance. It should be covered when it is not in use to prevent dust buildup. Grime accumulates on the edges of glass flats, creating a source of film abrasion. Because of this, glass flats and carriers should be cleaned regularly. For more information on maintaining microform reader/printer/scanners, consult with your vendor.

An example of an internal maintenance manual for microform reader/printers is available from the Richard Stockton College Library at http://talon.stockton.edu/periodicals/manuals_equipment.html

DISASTER PLANNING

Disaster planning is critical for microform collections. Microforms are highly susceptible to water damage and must be protected from flooding or burst pipes. Once wet, this material must not be allowed to dry in rolls or enclosures, as it will stick to itself and to the enclosures. Wet microforms must be removed from their enclosures and rolled film must be unrolled for drying. Air-drying is acceptable, but it is better to locate, in advance, a local film processing lab that can provide this service in the event of an emergency. Microfiche can be dried flat, emulsion side up, in single layers or clipped to a drying line by an edge that bears no image.

Wet microforms should not be frozen or freeze-dried since film layers may separate as a result. If microforms cannot be air-dried immediately, they should be immersed in clean, cold water and sent to a laboratory for safe reprocessing within 48 hours of getting wet.

Mold growth must be avoided on all film types. Mold will damage the emulsion layer of the film/fiche, rendering it soluble in water. If mold infects film/fiche, seek professional assistance.

DIGITAL CONVERSION OF MICROFORMS

Microforms can be scanned to improve access. The primary concern is that a poor quality microfilm will result in poor quality scan. Even a good quality scan will not guarantee a reproduction quality image.

Microfilm is a high grain (larger silver particle size) film and comes in both high contrast and continuous tone. In general, microfilm or microforms scanned at a minimum of 400 ppi and 8-bit grayscale will give good results. For the best results, scan from the print master and base the resolution for scanning on the size of the original, not the size of the film.

In general, keep these criteria in mind when selecting microforms for digitization:

- Best results come from microfilm with lower reduction ratios (below 20x)
- Film and fiche should have a consistent density
- When possible, scan the print master
- Scratches are difficult and time consuming to eliminate on the digital image
- Polyester is easier to scan than acetate
- Out-of-focus film/fiche results in out-of-focus scans

CONCLUSION

With the proper care and storage, microforms are a stable preservation format. Unlike its digital counterpart, microfilm is the product of a nearly static, tested technology that is governed by carefully crafted national standards. It is also worth noting that, while digital data require use of a sophisticated retrieval system to access their treasures, microforms can be read by the naked eye using only light and magnification. Many historic collections can be found only on microforms today, and their preservation is important.

ACKNOWLEDGMENTS

NEDCC is grateful for the significant contributions made by Steve Dalton and Karen Motylewski, who wrote versions of the original preservation leaflet updated here.

FURTHER READING

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