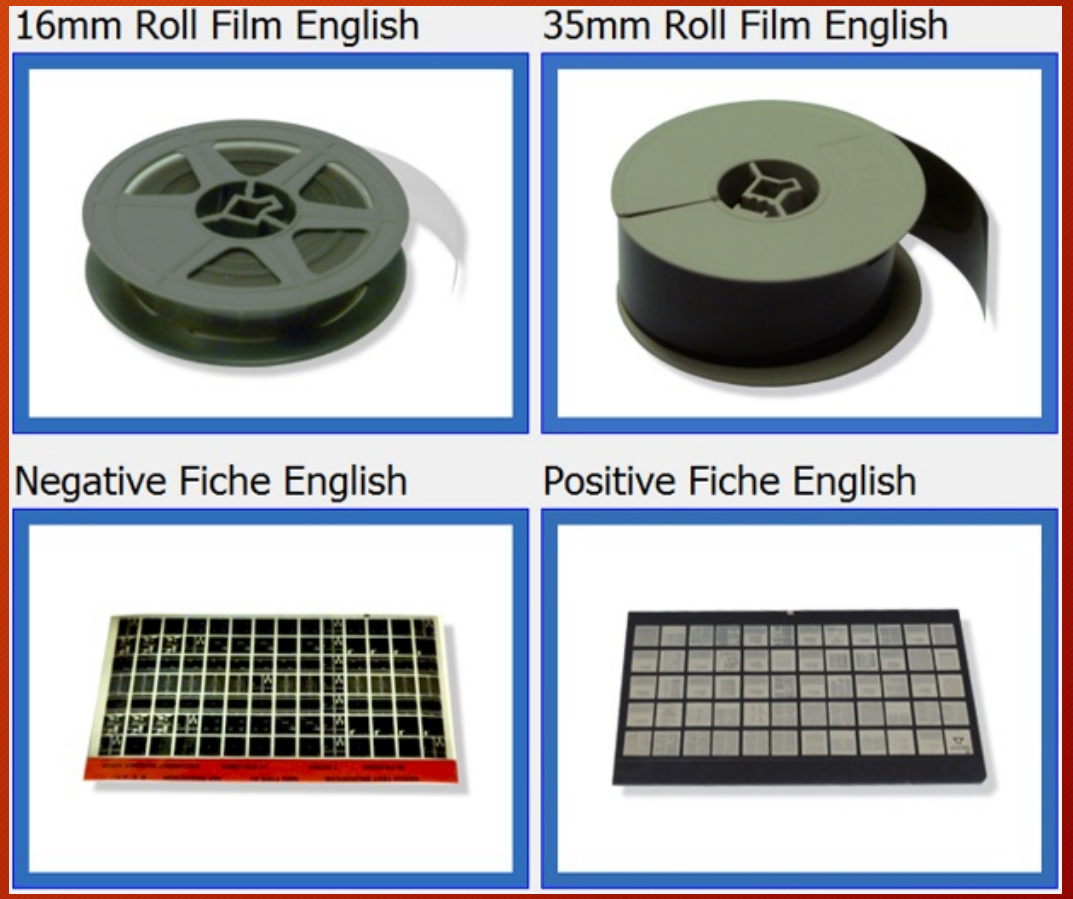
Microfilm “Diseases”

Common Microfilm diseases and how to prevent them

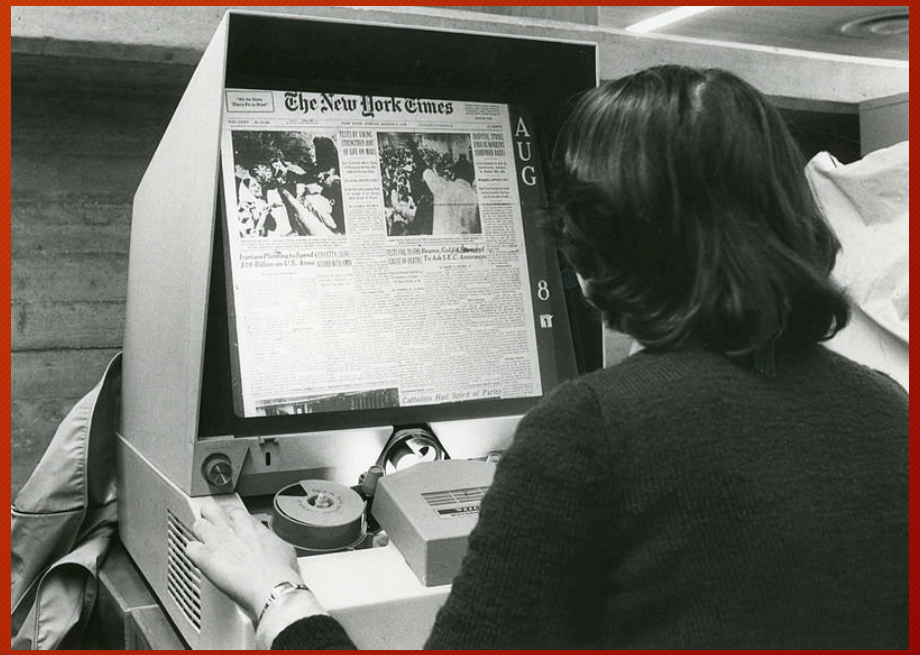
Introduction

- 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).



Brief 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.

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

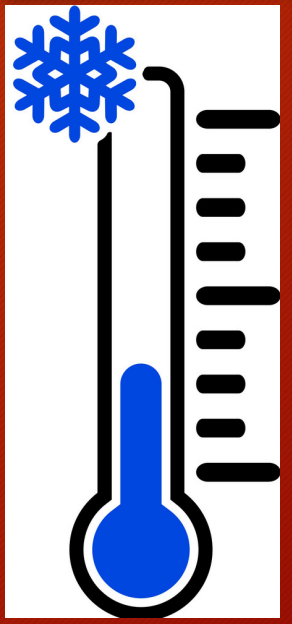
Vesicular films use an inexpensive process to create use copies of film and fiche. These films take advantage of the fact that diazonium salts produce nitrogen as they decompose when exposed to UV radiation. In vesicular films, diazonium salt coating is sandwiched between two base layers. The film is 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.

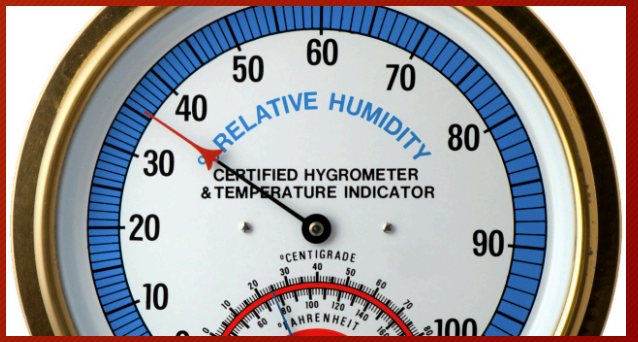
The vesicular film base must be polyester because acetate cannot tolerate the heat used in processing. Mechanical pressure frequently causes damage to vesicular film, as pressure will collapse the bubbles. Another major vulnerability becomes apparent at high temperatures (such as those caused by heat-emitting 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.

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

- Dust is 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.

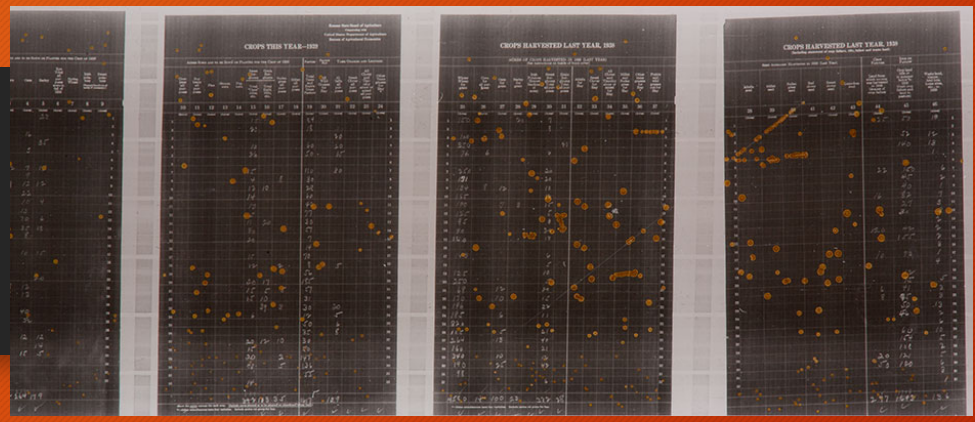
- Gaseous air contaminants, such as oxides of sulfur and nitrogen, paint fumes, ammonia, peroxides and ozone can damage film bases and emulsions. These contaminants may produce oxidizing or reducing effects that cause micro-blemishes on silver-gelatin films. Precautions must be taken to reduce the risk 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.

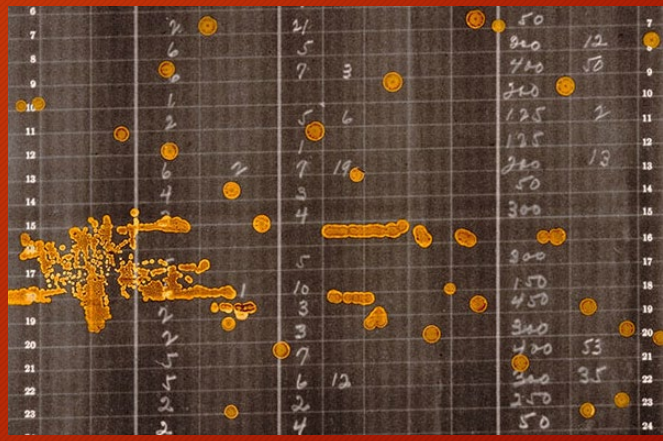
- Diazo, vesicular, and silver-gelatin films and fiche should not be rolled on the same spools, sleeved in the same enclosures, or stored in the same containers so as to prevent chemical interactions with each other. Space and access problems usually make separate cabinets for different film types impractical,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

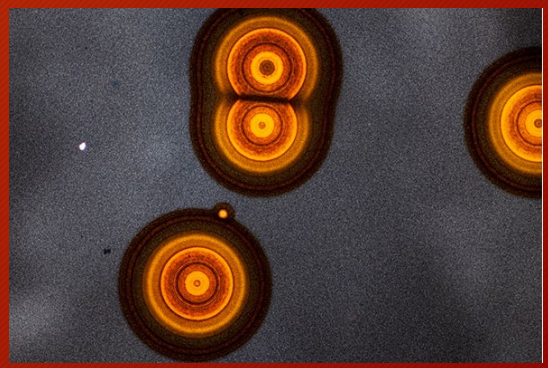
Diseases

Redox

- Redox blemishes appear as small pink, orange, or yellow spots in the image area when viewed in transmitted light. When viewed in reflected light, they can appear brown or other colors. Redox spots are normally circular in shape. A product of corrosion, redox blemishes are frequently seen in microfilm.
- Redox blemishes are manifestations of local oxidation of metallic silver. Images on black and white film are typically formed by metallic silver in a gelatin binder. When exposed to a combination of moisture in the environment and pollutants in the air or contaminants in the film's enclosure, this image silver will corrode.
- Image-forming metallic silver exists in a filamentary structure. When corrosion occurs, oxidative gases permeate the gelatin and attack small sites of silver, severing them from the filamentary structure and converting them into silver ions. The silver ions migrate through the gelatin and reduce as very small particles of colloidal silver, redepositing in new locations. Colloidal silver has a red/brown or yellow appearance, seen in the familiar color of redox spots.







What you can do

- Moisture in the air is the critical factor that causes oxidation of the silver image, so prevention of corrosion requires an environment with controlled relative humidity, preferably between 20-50%. Storage of film in an environment free of pollutants and in inert enclosures is recommended for prevention of silver oxidation. A low temperature environment is preferable, but is not as important in the prevention of oxidation as is the control of relative humidity and the reduction of contaminants in the film's enclosure.

- Microfilm can be protected from redox blemishes with polysulfide treatment. Polysulfide treatment involves washing the film in a polysulfide solution that converts the silver in the film to silver sulfide, a more stable compound that resists oxidative attack. The ideal conversion percentage is approximately 65%, insuring the stability of the image while also not significantly altering the density of the image. Kodak Brown Toner is an appropriate polysulfide treatment.

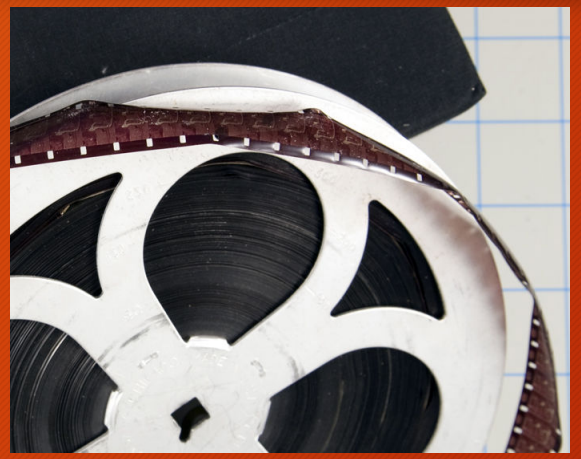
Diseases

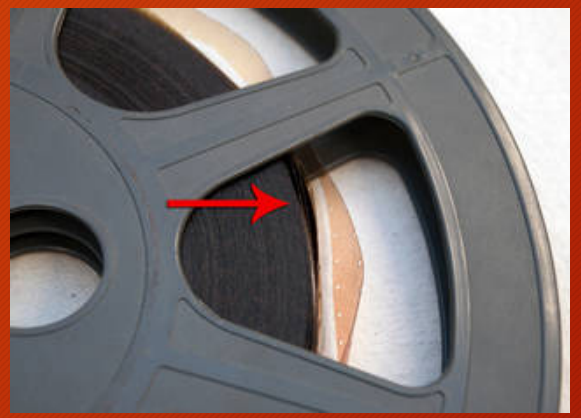
Vinegar Syndrome

It's actually slang for how the chemical breakdown of acetate microfilm leads to a strong vinegary smell.

Acetic acid, which accelerates microfilm's decomposition, gives household vinegar its characteristic smell and taste.

Most microfilm produced after the mid-1980s uses a polyester base that is not subject to vinegar syndrome. So if you have microfilmed documents preserved in this format and they're stored in climate-controlled conditions, you have nothing to worry about.





What you can do

- Improve the storage environment. You can stabilize moderately deteriorating film for decades in a drier and colder environment. Note that while this technique can slow the deterioration of film in an advanced stage of decomposition, it can't reverse it.
- Remain vigilant. Acetate films may show little or no evidence of deterioration, but they're still living on borrowed time. Even if you decide to leave things as they are, you'll need to monitor your microfilm. An easy way to do this is to place acid-detection test strips next to the film and check them periodically. Changes in the strips' color indicate an increase in acetic acid. ALL acetate film will eventually succumb to vinegar syndrome.
- Quarantine infected films. Vinegar syndrome is contagious. This is why you need to keep deteriorating films away from uninfected films.
- Duplicate or convert the deteriorating film to a digital medium. Once deterioration starts, it can move quickly, so you'll need to act while the information is still readable and can be duplicated or scanned easily.
- Banish moisture. You can sometimes slow degradation by placing desiccants such as silica gel or activated charcoal (also known as "molecular sieves") in the film container to absorb moisture and acid. However, this isn't a set-it-and-forget-it strategy; the sieves must be checked regularly and replaced as needed. Consider this a stopgap measure you can use while looking for a longer-term solution.

The End

Thank you for your Attention!