



SAVING YOUR Treasures

A Website about what you can do to protect and preserve the things of importance in your life



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CARE OF NITRATE AND ACETATE FILMS

The plastic base films for negatives are divided into three broad types: cellulose nitrates, cellulose acetates, and polyester. Film base is composed of a clear plastic base, a thin layer of gelatin (or other) emulsion, and an embedded image. The image may be composed of color dyes in the emulsion as in color film or small particles of silver in the emulsion as in black and white film. Cellulose nitrate, cellulose acetate, and polyester have been used as a support for negatives, positive transparencies, motion pictures, microfilm, and other products. Though cellulose nitrate and acetate yield wonderful pictures, they are chemically unstable. When stored with other objects in the collection, this instability may destroy other photographs and can cause serious health and safety risks.

Nitrate films deteriorate and produce aggressive gases such as nitric oxide and nitrous oxide. These gasses combine with moisture in the air to form nitric acids that attack nearby objects. Deteriorated nitrate film can become very unstable and can spontaneously ignite. Acetate film base, known as "safety" film, is also unstable. Cellulose nitrate and acetate films are autocatalytic; once deterioration begins the products (gases) encourage more deterioration. As acetate deteriorates it shrinks causing distortion of the emulsion, which does not shrink the same amount as the acetate base. Acetate film gives off acetic acid gas as it deteriorates which attacks other objects and smells like vinegar.

Identification of Nitrate Film:

In 1889, Eastman Kodak patented the first thin, clear, and flexible celluloid accepted to make roll film. This innovation was the beginning of the photography craze. Flexible films allowed professional photographers to take more pictures in more circumstances and created a new market for amateur photographers. The new convenience of flexible lightweight film base quickly became the economic foundation of the photo industry. The manufacture of cellulose nitrate film stopped in 1950. A photographic collection that contains images from 1890-1950 has nitrate film in it. The Northeast Document Conservation Center lists four ways of identifying cellulose nitrate film.

They are as follows:

- 1) *Edge Printing* — Manufacturer's stamped rolls of film with identification along the edge of the roll. The identification information usually included the manufacturer and the type of film: nitrate or safety.
- 2) *Dating Information* — Kodak Eastman is the only manufacturer that supplied dates on nitrate film production. See 'Chronology of Film' at www.kodak.com.
- 3) *Deterioration* — Nitrate degradation is a slow process. As the film deteriorates, it shrinks and releases such gases as nitric oxide, nitrous oxide, and nitrous dioxide. As cellulose nitrate degrades it becomes highly flammable at low temperatures. The film should be isolated and properly stored away from other types of photographs.
- 4) *Testing* — Tests provide a more exact but not perfect way of identification. Four tests used in identifying cellulose nitrate film are polarization, diphenylamine test, burn test, and float test. To learn more about testing read the NEDCC's "A Short Guide to Film Base Photographic Materials: Identification, Care, and Duplication," at www.nedcc.org.

Identification of Acetate Film:

Around the 1920s, cellulose nitrate films began to be replaced by acetate film. The new film was developed as an alternative to the highly flammable nitrate films. The Northeast Document Conservation Center lists four ways of identifying cellulose acetate film.

They are as follows:

- 1) *Edge Printing* — Manufacturer's stamped rolls of film with identification along the edge of the roll. The identification information usually included the manufacturer and "SAFETY" to identify acetate film.
- 2) *Dating Information* — To view a list of acetate production dates, read the NEDCC's "A Short Guide to Film Base Photographic Materials: Identification, Care, and Duplication," at www.nedcc.org.
- 3) *Deterioration* — As acetate film deteriorates, the cellulose acetate base begins to shrink but the emulsion does not causing the negative to wrinkle. A slow form of acetate degradation is "vinegar syndrome." As the film deteriorates it undergoes chemical reactions that spread into the gelatin emulsion on the plastic base and into the air creating a harsh, acidic odor often resembling vinegar. The film should be isolated and properly stored away from other types of photographs.
- 4) *Testing* — Tests provide a more exact but not perfect way of identification. Four tests used in identifying cellulose nitrate and acetate film are polarization, diphenylamine test, burn test, and float test. To learn more about testing read the NEDCC's "A Short Guide to Film Base Photographic Materials: Identification, Care, and Duplication," at www.nedcc.org.

Storage of Nitrate and Acetate Films:

The best way to preserve nitrate and acetate film is to maintain a stable and suitable environment. The deterioration of cellulose nitrate and acetate film is highly dependent on the temperature and relative humidity in the storage area. By also storing these films in a dark and well-ventilated area, the gases released during decomposition will be able to dissipate. (See the references below for more information on storage and monitoring acetate film base.)

The best method of storage for nitrate film is to keep it in a freezer. This method slows the natural decomposition of the material. For a small collection, this is a relatively easy solution but can be prohibitively expensive for large collections. Another method of storage, and one that is least costly, is to strive for a controlled environment in which the temperature is a constant 32-40°F with a relative humidity between 20-30%. These ranges reduce the rapid deterioration of nitrate film.

Cellulose nitrate films should be stored apart from other negatives in a collection. Three layers of protection are recommended for nitrate films. The material should be placed within individual plastic sleeves. The photograph sleeves should be seamless and open on three sides to allow for the dissipation of harmful gases. The plastic sleeves should be placed within an acid-free box. Be careful to not crowd negatives into the box. Overcrowding may lead to the loss of all the nitrate film in a collection. Lastly, place the box within the freezer or on a shelf. **Caution: Never seal nitrate film in an airtight container at any time. The gases and heat created while in storage must be allowed to escape.**

Resources:

Fischer, Monique. "A Short Guide to Film Base Photographic Materials: Identification, Care, and Duplication." *Northeast Document Conservation Center Leaflet 5.1*.
<http://www.nedcc.org/resources/leaflets.list.php>.

Nadeau, Luis. 1997. *Encyclopedia of Printing, Photographic, and Photomechanical Processes*. New Brunswick, Canada: Alteir.

National Film Preservation Foundation.
<http://www.filmpreservation.org/index.html>.
<http://www.filmpreservation.org/preservation/fpg.pdf>

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