Preserving Motion Picture Film

What Are Some Important Characteristics of Motion Picture Film Formats?

The possibility for moving images as we know them was born when Kodak released the first flexible transparent roll film in 1889. Using the new film, technical innovators created cameras and projectors that recorded a series of still images and displayed them to audiences by shining a beam of light through the film and projecting it on a screen. Unlike audio and video formats, the basic scheme of motion picture film has been more or less standardized for over a hundred years. There are a wide range of technical characteristics that make up film, however, and allow for a diversity of film types.

Table of Contents for Motion Picture Film:

There are several layers comprising motion picture film. The base and emulsion layers are the most important in defining film's characteristics.

Base: The film base is the layer of plastic that supports the images, sound, and other information contained in the emulsion. There are three main types of film bases: nitrate, acetate, and polyester.

- **Nitrate**: The earliest film stocks used a cellulose nitrate base. Nitrate film is highly flammable, which was clearly a problem for its continued use. Take caution if you suspect that you have nitrate film (additional guidance is provided in Identifying and Handling Nitrate Film, by the Association of Moving Image Archivists' Nitrate Interest Group). The inherent danger can be mitigated by proper storage, but it is not recommended that individuals keep this material in their homes.
- **Acetate**: As early as 1910, cellulose acetate stocks were introduced to the market. Acetate films do not burn like nitrate films, which is why they are referred to as "safety film." Films intended for home use were almost exclusively made with an acetate base. There have been a number of different types of acetate films, all of which have their own preservation issues but most notably a common form of base degradation referred to as "vinegar syndrome".
- **Polyester**: Polyester stocks are more durable than acetate and are not nearly as prone to decomposition. Polyester stocks were introduced in 1955 and have been used primarily for exhibition prints and preservation purposes.

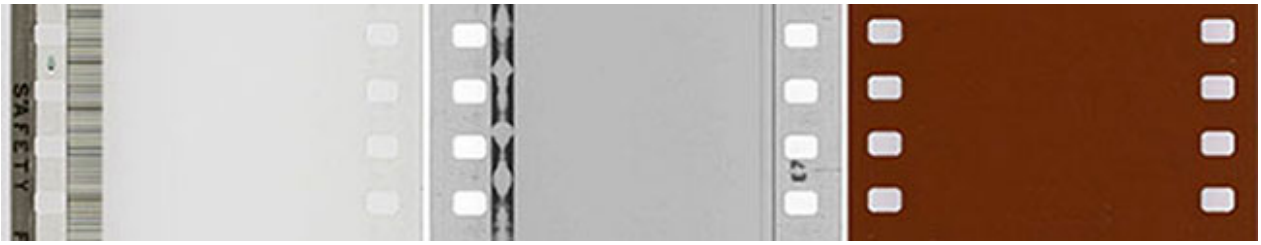
Emulsion: The emulsion is the part of the film that actually contains the image. The emulsion is comprised of gelatin and photo-sensitive materials that, when exposed to light and processed through chemical baths, result in an image. There have been hundreds of different emulsion types in the history of film. You can read more about some of these different films and see images in Identifying Formats and Condition Assessment.

Here are additional characteristics that you might encounter:

Color: Prior to modern color film processes, film was hand-painted, tinted or toned in order to add color. There are also many early processes that required extra equipment to present the image in color. More modern color processes embed dyes or pigments in discrete layers within the emulsion to create successive layers of cyan, magenta and yellow colors that can be combined to create full color.

Examples of common early color systems: Blue-tinted stock, yellow-tinted stock with blue toning, and untinted stock with blue toning.

Soundtracks: Soundtracks are most often seen as a squiggly or banded line running lengthwise on the side of the film, but there have been a number of other types of soundtracks, from separate disks and magnetic films to digital information printed directly on the film.



Examples of common soundtracks: a variable density optical track, a variable area optical track, and a full coat magnetic track.

Where can I find more information?

- Kodak's Chronology of Film provides a great deal of detail about the development of film stocks from 1889 to the present
- The National Film and Sound Archive of Australia's Film Preservation Handbook includes more technical detail and diagrams of film layers.
- More information on vinegar syndrome can be found at the National Film Preservation Foundation website.
- Timeline of Historical Film Colors tells you everything you ever wanted to know about historical color processes.
- For more information about a less common color system, read Kodacolor Decoded: Early Color Footage of Yellowstone National Park a U.S. National Archives and Records Administration blog post about an early color film of Yellowstone National Park.
- The Association of Moving Image Archivists' guide, Identifying and Handling Nitrate Film will help determine if that film in your attic needs to be treated as a flammable material and provides guidance about what to do with nitrate film.

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