

Film Stock

Film stock is an analog medium that is used for recording motion pictures or animation. It is a strip or sheet of transparent plastic film base coated on one side with a gelatin emulsion containing microscopically small light-sensitive silver halide crystals. The sizes and other characteristics of the crystals determine the sensitivity, contrast and resolution of the film. It is the basic component of all motion pictures, allowing images to be captured and reproduced through the use of a camera.

In 1889, Eastman Kodak introduced a flexible, transparent roll film made from a plastic substance called celluloid. Kodak chemists had perfected the celluloid film that had been invented and patented in 1887 by the Reverend Hannibal Goodwin. In 1891, working under Thomas Edison (1847–1931), W. K. L. Dickson (1860–1935) designed the first motion picture camera, the Kinetograph, which used Kodak celluloid film stock. By 1911, Kodak was manufacturing over 80 million feet of film stock annually for the film industry, and the company continued to be the major supplier of film stock internationally throughout the twentieth century. With the rise of the digital age in the twenty-first century, Kodak has evolved to produce and support digital filmmaking and projection equipment.

Since the early experiments with celluloid film in the late 19th century, the motion picture world has undergone constant revolution through the development and improvement of film. Thanks to applied technical wizardry, film has moved from the grainy black and white images of the original Kodak camera to the colorful marvels of modern stock in just over a century.

Originally, film was built on a paper base, making the composition of moving pictures an incredibly difficult process. Celluloid film stock, which was flexible and less delicate than paper, became heavily marketed by several early film pioneers, including George Eastman and Thomas Henry Blair. Despite the considerable advantages given by celluloid film, early film stock was deficient in a few serious matters: it was unable to process red light, and had no standardized size.

In the early days, film cameras were often unique to their creators, leading to all kinds of variation in the size of film used. As equipment became more standardized, film stock began being issued in a few typical sizes, most notably the 35, 16, and 8 millimeter widths. The matter of film being rendered in realistic color was not addressed until the early 20th century, with the invention of panchromatic film that could see red, blue, and green layers of light.

Today, modern film stock is a lot more complicated than it looks. Instead of a simple piece of dark flexible material, a typical piece of film contains several different layers of emulsions and filters. On top of a safety base, an anti-hilation layer prevents fogging, followed by layers of red, green and blue emulsions each with a filter between them. The film stock also contains yellow, magenta and cyan dyes that are released during processing to give a full spectrum of color.

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BASE AND EMULSION

Celluloid film is made up of a flexible, transparent base that is coated with a gelatin layer (the emulsion), which contains millions of tiny, light-sensitive grains. When the film is exposed by the shutter in the lens, the grains absorb light, creating a latent image that is not visible to the naked eye. The film is then treated with developing chemicals, which cause the exposed portions of the film to become visible in a negative image of the original scene: light and dark areas in a scene are reversed. The film is then "fixed," which removes the developing chemicals, and the undeveloped grains are washed away to prevent further exposure of the film. The negative film is then printed by allowing light to pass through it onto a second strip of film, creating a positive film for projection.

A few early film cameras used paper film stock. Evidence suggests that around 1883, French photography enthusiast Louis Le Prince (1842–1890) built and experimented with a single-lens camera that used a paper negative film. Prior to 1912, the Kinora Film Company offered an amateur camera and viewing device that utilized paper film stock in a flip-book format.

GAUGE AND SPEED

Film stock is available in a number of gauges, or widths. Wider gauges project a sharper image, while smaller gauges tend to be grainier. A number of experimental widths have been used in filmmaking throughout the history of cinema, but the most common gauges still in use today are 35 mm, 16 mm, 8 mm, Super 8 mm, and 70 mm.

In purchasing film stock for a motion picture, speed and resolution are two key qualities to consider. The width of the film determines the resolution, or image

sharpness, given by the film. 8 mm film typically has the lowest resolution, while 35 mm film is the standard form almost all major motion pictures. Film speed determines how sensitive the film is to light; if a lot of night scenes are planned, higher film speed may be necessary. However, higher film speed may lower the resolution, so filmmakers tend to look for a happy medium in terms of resolution and speed.

Film stock can be quite pricey, depending on the width of the film and length of the roll used. With 35 mm film, a 1000 ft (304.8 m) roll will result in approximately 10 minutes of usable film, and will usually start at about \$500 US Dollars (USD.) Using lower resolution film, such as 8 mm, will result in more time per foot of film, and may be a wise solution for amateur or low-budget filmmakers. Some enterprising independent filmmakers choose to avoid film stock altogether by shooting on digital cameras, but film cameras are still considered the giant of the motion picture industry by most experts.

The speed (sensitivity) of the film stock also affects the quality of the image in projection. Slow film stock is less sensitive to reflected light, so brighter light sources are necessary during shooting to produce sharp images. Slower stock also creates less contrast between light and dark areas within a composition; fast film stock is very sensitive to reflected light and produces distinct contrasts between light and dark within the frame. Fast stock is often used for documentaries, in settings where light options are limited, and in fiction films that try to capture a stark, documentary feel.

BLACK-AND-WHITE AND COLOR

Color was achieved in early cinema through methods of postproduction tinting and toning. Tinting is a technique that applies one or more colors to certain areas of the film stock by hand. The practice began as early as 1895, in an Edison-produced film, *Serpentine Dances*. In the film, a woman dances in circles as her dress and scarves change colors, as if by magic. Edison's crude tinting techniques proved difficult on the eyes, but by 1905, a stenciling process was perfected that created a bit more accuracy in color distribution on the celluloid.

Toning imparts a color to an entire black-and-white film. By 1920, over 80 percent of all Hollywood feature films used toning to represent particular settings or emotions: for example, amber for day or interior shots, blue for nighttime, red for battle scenes. In 1921, Kodak began manufacturing pre-toned film stock in nine different colors. After the arrival of sound technology in 1927, tinting and toning were temporarily halted because the processes interfered with the soundtrack, which ran alongside the image on the celluloid. By 1929, this problem had been

corrected, and Hollywood continued to use tinted and toned stock copiously until more sophisticated color filming techniques were perfected—the preview trailer for *The Bride of Frankenstein* (1935), for example, was shot on green-toned film stock.

Dozens of experimental processes were tried in the early 1900s to capture realistic color on film, but most lacked quality and were quickly abandoned. Technicolor was invented in 1917 by Herbert Thomas Kalmus (1881–1963) and Daniel F. Comstock and eventually became the industry standard in Hollywood. The first version of Technicolor superimposed two colored images (one green, one red) onto the screen simultaneously. The process was too expensive to use for an entire feature film, but Technicolor sequences in black-and-white films quickly became fashionable in Hollywood—for example, in Cecil B. DeMille's *The Ten Commandments* (1923).

In 1932, Kodak introduced a Technicolor film stock capable of reproducing a reasonable range of hues, using a three-color process. With three strips of black-and-white film running together through the camera, the color image was recorded by separating its green, blue, and red properties onto each of the corresponding color-sensitive negatives. From these three negatives, three more strips of film (known as matrices) were printed; these were used to transfer corresponding dye images onto a single blank piece of film. Walt Disney was one of the first filmmakers to experiment with this process, creating *Flowers and Trees* (1932), the first animated short in full color.

Types of Film stock

8mm

Amateur film gauge introduced by Eastman Kodak. In the camera, it was the same size with standard 16mm film but with double perforations. At the picture area of a typical 16mm film, four frames of 8mm were recorded, two in the first run and two when turning the film cassette to the other side to expose the other half width, much like audio cassettes are used. When processed, it was slit lengthwise to produce a double length (usually 50ft) Regular 8mm film for projection. A better variant, Super 8mm was introduced by Eastman Kodak in 1965. This had smaller perforations which allowed for 50% increase of the image size and hence more detail could be recorded. The larger frame also allowed for larger projection sizes than were possible with standard 8mm (called Regular 8mm) film. See also respective sections in Wikipedia and Kodak's web site.

Super 16mm

Super 16mm film is physically 16mm wide, however, when compared to standard 16mm film one will notice that 16mm has perforations on both edges of the film, whereas super 16mm only has perforations on one side. This allows for a wider frame on the film and provides greater resolution to that achievable with standard 16mm film stock.

35mm

35mm Film Stock is regarded as the industry standard when it comes to professional productions. There are a few different types of 35mm film, including:

Two perf

Three perf

Four perf

Super 35mm

65/70mm

This type of film stock is the largest format made, it is generally used for IMAX productions. It is the highest quality film available.