The exposure of imagesetter film by a laser beam is one critical factor involved in final film quality. To understand the interaction of film and laser requires some background information on both subjects.

Lasers

> Laser - A device that converts incident electromagnetic radiation of mixed frequencies to one or more discrete frequencies of highly amplified and coherent radiation.
> Source: American Heritage Dictionary.

The word 'laser' is actually an acronym: **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation.The dictionary definition of a laser is quite complex. (See box to left.) What is important to us is that the light from a laser is amplified and coherent. This makes it possible to expose a small mark on a piece of film in a fraction of a second. Other light sources, sunlight for example, are not amplified, and contain elements from many wavelengths.

All visible light can be described as being made up of a one or more wavelengths. The visible color spectrum (see Figure 1) ranges from violet (at a wavelength of around 400 nanometers[1]) to red (around 700 nanometers). Those of you familiar with additive color theory will remember that white light is actually made up of many different colors of light. The additive primaries of light (red, green and blue) may be used to create a wide range of colors.

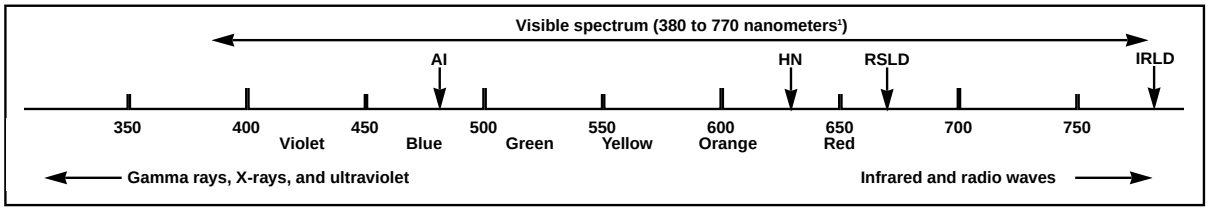

Figure 1 - The spectrum, showing the range of visible light. The abbreviations AI, HN, RSLD, and IRLD signify the wavelengths of argon ion, helium neon, red-sensitive laser diode and infrared laser diode lasers.

[1]A nanometer is equal to:
- One millionth of a millimeter
- One billionth of a meter
- One thousandth of a micron
- .00000003937 of an inch

Artificial light sources may contain light from throughout the spectrum. In some cases, the relative energy of the light is stronger towards one area of the spectrum. For example, artificial tungsten light tends to be stronger towards red which may make objects appear reddish. Lasers, with their extremely coherent wavelengths, fall in a precise area of the spectrum.

Films

Films for imagesetters and typesetters are usually described as being sensitive to a particular color (i.e., wavelength) of light. For example, many laser imagesetters use so-called red-sensitive films. What this means is that lasers with wavelengths around 650 nanometers will be able to expose this type of film. If you tried to expose a red-sensitive film with the wrong type of laser, you might find upon development that the exposure had little or no effect. On the other hand sunlight, because it has a wide range of wavelengths, would expose any light-sensitive film.

The photographic film or paper that sticks out of the end of a film cassette is exposed by artificial light or daylight. For convenience, daylight load rolls of film make it possible to load film without a dark room. But if you did load laser imagesetting film in a dark room, you might find that you could keep a light on as long as the light didn't have any of the same wavelength as the film you

were loading. For example, you see red lights in many photographic darkrooms since most black & white films are not sensitive in the red range. However, if you wanted to handle a red-sensitive film without exposing it, you might choose a blue, green, or yellow 'safe' light.

There are different photographic papers and films for different graphic arts lasers, and they are formulated to be primarily receptive to a certain wavelength of light. Today there are many films which are specifically tailored for the narrow wavelength range of certain lasers (and which may not be compatible with other lasers.)

Graphic arts lasers

There are primarily two kinds of lasers used for graphic arts applications: laser diode lasers and gas lasers. The following list covers some of the major characteristics of each laser:

A **laser diode** is a solid state laser which can be turned on and off more easily than other lasers. This results in simpler optical systems. Laser diode technology is attractive because of its low upkeep and replacement cost. Laser diodes have been used in a wide range of imagesetters, and ordinarily produce light in the red (around 670 nanometers) or infrared (around 780 nanometers) portion of the spectrum.

Helium neon and **argon ion** lasers are continuously-running gas lasers, which must be turned on and off via an optical system. This makes them less sensitive to temperature variations than laser diode lasers. Both helium neon and argon ion lasers have been used in imagesetters and output scanners for over a decade. Helium neon lasers produce a very sharply defined red light around 630 nanometers. Argon ion lasers produce a blue-green light around 480 nanometers.

Hard and soft dots

There has been a lot of controversy concerning the nature of the marks that a laser makes on film, and how that affects halftone dots. Briefly, given that film and processing are running correctly, all lasers will produce hard halftone dots on photographic film or paper. Soft halftone dots are produced using process cameras and conventional halftone screening. (For an in-depth discussion of the subject, please refer to the Linotype-Hell technical information piece entitled Hard Dots, Soft Dots, part number 3069.)

The appearance of an image on film depends on the minimum density of clear areas, the maximum density of dark areas, and the sharpness of edges. Some films maintain fine detail better than others, but this usually reflects the quality of the film rather than the laser.

Conclusion

Quality differences exist between imagesetters, but it is unwise to focus on the type of laser when evaluating quality issues. Remember that it is the job of the laser is to provide the smallest mark on film that an imagesetter can make. These marks are then used to build letters, rules, and halftones dots. The best way to see if the laser is doing its job is to examine films. The films will show you what the system (and the operator) can achieve. In the long run, film material, film processing, the imagesetter transport and optics contribute more to the final quality of films than the laser type.

Comments

Please direct any questions or comments to:

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