WHAT IS DICHROIC GLASS?

“Dichroic Glass” is somewhat of a misnomer since the dielectric coating that produces all the interesting colors on a piece of glass is not glass at all, but a group of very thin layers of metal oxides. This stack of thin layers has a total thickness of 3 to 5 millionths of an inch. The stack of materials produces an “interference filter” which creates the varied and unique color characteristics that we see. Since the total thickness is so minute, the filter has very little mechanical integrity of its own and must be supported on a mechanically stable substrate. Glass is the ideal candidate for this substrate. It is transparent, has adequate rigidity, is stable, withstands relatively high temperatures, and is not affected by moisture, solvents or most acids. The materials producing the filter are actually more chemically stable than most glasses used as the substrate. The filter is generally as durable as the substrate it is on. Thus, what we commonly call Dichroic Glass is actually a dielectric interference filter attached to the surface of a piece of glass.

CHARACTERISTICS OF DICHROIC GLASS

To start to unravel the many application possibilities of Dichroic Glass the artist needs a fundamental knowledge of its characteristics. The first element that needs to be understood is that the filter materials are all clear and have no color inherent in the materials. Secondly, there is effectively no absorption of visual light by the materials. There are no dyes, paints or gels. And thirdly, there is a fundamental relationship that all of the light energy is either transmitted or reflected.

The interference filter produces the colors that we see by acting as a selective color mirror. The color that is reflected in this mirror is produced by the optical design of the filter. The balance of the light that is not reflected by the selective color mirror is transmitted. All of the light energy that hits the surface of the filter must be accounted for in the reflected and the transmitted light since none of the energy is absorbed. This is in contrast to a typical piece of colored glass where the light energy hitting the surface enters the glass and part of the color spectrum is absorbed. The only light energy emitting from the glass is the part of the color spectrum that is not absorbed.

The colors available from the typical designs used by most manufacturers are actually a pair of rainbows—one in transmission and a different one in reflection. The only difference in the filter when producing the possible colors is the thickness of the layers making up the filter.

The interference filter has the unique characteristic of shifting its color as you change the angle of view. As you rotate the filter from viewing directly through the filter the apparent color changes as if the layer thickness of the stack is getting thinner. The intermediate colors will shift down the rainbow. The colors of a true, natural rainbow produced in our atmosphere are usually considered to be in the sequence of violet-blue-green-yellow-orange-red. In the typical simple single stack Dichroic Glass design used by most manufacturers, the reflective rainbow is similar to the natural rainbow. The transmitted rainbow is, however, in the sequence of yellow-magenta-blue-cyan. Since there is no green or red available in the transmitted rainbow a second more complex two stack design is often used that provides a transmitted rainbow similar to a natural rainbow. This allows the production of a sheet of Dichroic glass that transmits green or red.

The equipment used by the manufacture has the capability of centering the color of single sheet of glass at any point in the available rainbow. There are technical problems associated with maintaining a single color and the best efforts will vary with each manufacturer.

In the industry today there are differences in the manner of describing a given piece of Dichroic glass. One manufacturer may call the color of the glass the reflected color and another may call the color the transmitted color. Some have even gone to the extent of trying to introduce a third color produced when the glass is viewed at an angle. Unfortunately, there is not a standardization and all names are technically correct, but often times confusing. This coupled with the problem of all the possible variations of the artists’ perception of a given color produces a climate for confusion and misunderstanding. The artist must be familiar with the color relationships so that the obvious possibilities of confusion are minimized. The best approach for communication between the artist and the Dichroic glass supplier while using a set of color samples. Such a session should put the artist in a position of ordering and then receiving colors that will enhance the creative process.

For the artist actively using Dichroic glass, a second possibility to eliminate confusion is to submit samples of the colors that are desired in a given application. All manufacturers should be able to approximate a desired color from a sample. The artist must realize this will only produce approximate results based on the manufacturers equipment and controls. Each manufacturer will have different degrees of expertise in controlling his processes and ultimately the colors.

Dichroic Glass gives the artist another medium for self expression. The applications are expanding daily and are limited only by the imagination and ingenuity of the artist.

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