

Vikuiti™ Clear Card IR Filter

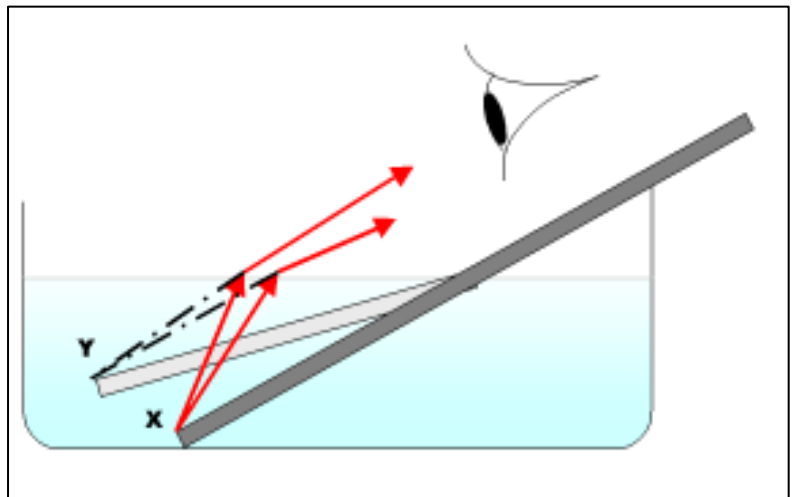


Clearly Unique

Laminated between two clear sheets of PVC, the Vikuiti™ Clear Card Filter allows nearly 100 percent transmission of visible light, while effectively blocking light from infrared (IR) LEDs. The result is a clear card with all the functionality of traditional, opaque cards and compatibility in ATMs, POS scanners and other IR LED-based devices. The Vikuiti Clear Card Filter also accepts traditional four-color printing in addition to a wide range of translucent inks, opening up whole new worlds of design and marketing possibilities. This leads to cards that are clearly different and clearly unique, with no worries about acceptance.

IR Filter Technology

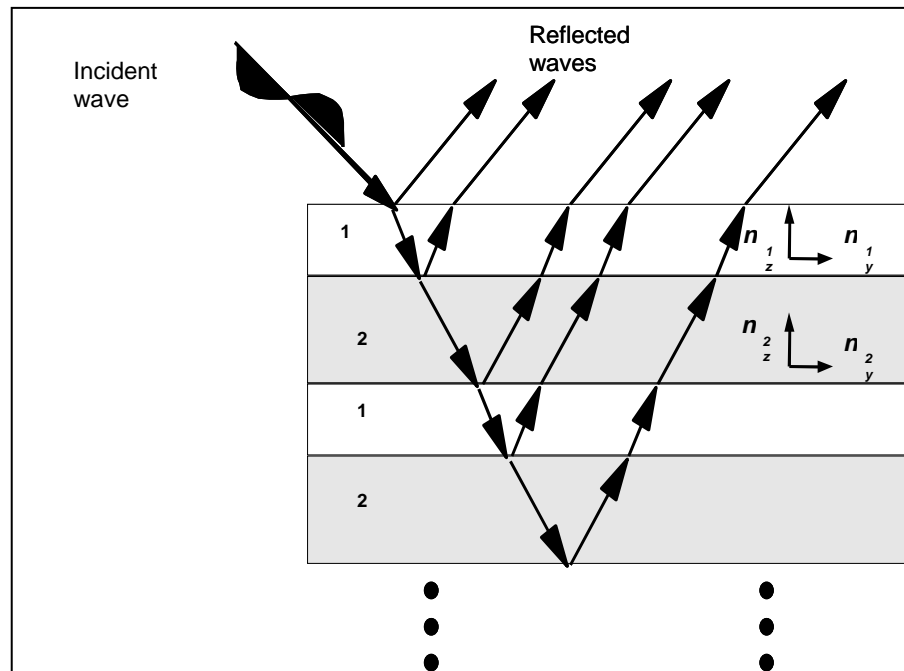
The heart of the Vikuiti Clear Card Filter is a proprietary multilayer optical film that relies on the reflection of light at the boundary of two materials. Such reflections depend on a change in refractive index from one material to the next. In optics, refractive index is analogous to the density of a material in chemistry or the viscosity or thickness of a liquid. When the refractive index changes from one medium to another, some light waves are reflected at the border between the two materials. A light ray will also bend, i.e. change direction, when passing from one material to another. If you've ever placed a straight object into a glass of water you'll notice that the object will appear to bend. This is caused by a change in the refractive index between air and water.



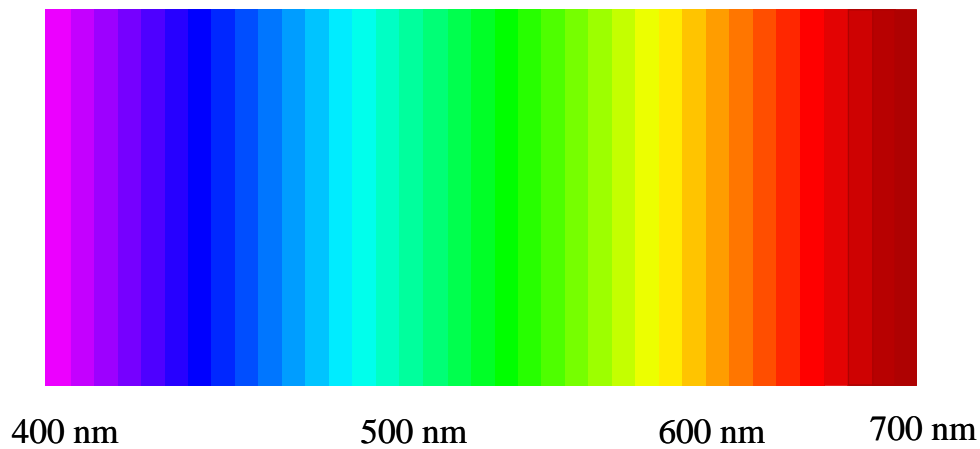
Refraction of light waves in water. The dark rectangle represents the actual position of a pencil sitting in a bowl of water. The light rectangle represents the apparent position of the pencil. Notice that the end (X) looks like it is at (Y), a position that is considerably shallower than (X).

This multilayer optical film is made of multiple alternating refractive index layers of specific thicknesses. By stacking many of these thin layers a mirror is developed. An everyday example of this is when you look out a window from a lighted room at night and you can see an image of yourself. A window consists of alternating layers of refractive indices; air, glass, air, glass, air. This causes the weak mirror that is observed.

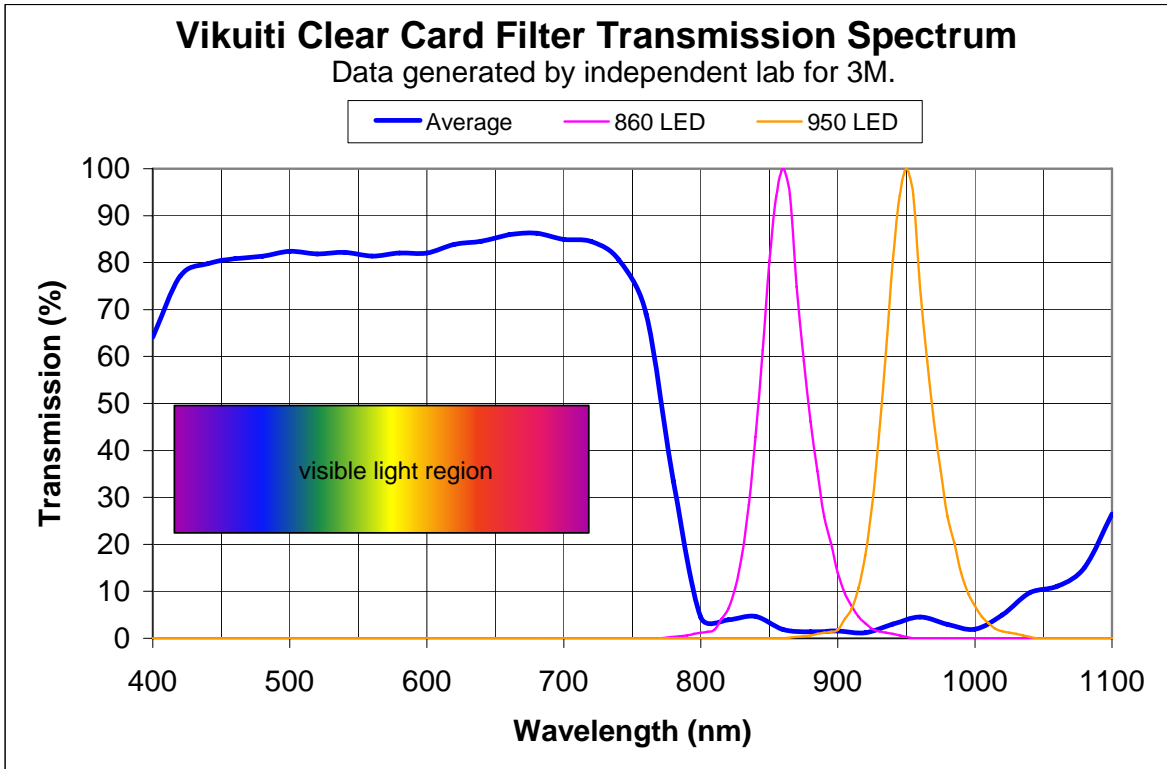
3M's Vikuiti Clear Card Filter uses over 400 alternating polymer layers, each approximately 200 nm in thickness (or 1/250th of a human hair), creating a very good mirror. The picture at right shows what happens as light enters a multilayer optical film.



Light is comprised of different wavelengths, some that the human eye can see, and others that we cannot. Below is a graph of the visible spectrum of light, approximately 400 nm to 700 nm. The wavelengths less than 400 nm are known as ultraviolet, and wavelengths above 700 nm are typically referred to as infrared. Both of these regions are unseen to the human eye.



These optical films are tuned to reflect specific wavelengths or bands of wavelengths. The tuning is done by adjusting the thickness of the layers to be a specific value compared to the wavelength of the light to be reflected. Generally, thinner layers are used to reflect shorter wavelengths, and thicker layers are used to reflect longer wavelengths. To reflect a wide wavelength band of light, a graded distribution of layer thickness can be used.



In the case of the Vikuiti Clear Card Filter, this tuning produces high reflectivity for infrared wavelengths of light, and low reflectivity for visible wavelengths. This tuning is what allows 3M to make a product that is clear in the visible region while remaining reflective in the infrared region. The graph above shows a typical spectrum of the Vikuiti Clear Card Filter and an overlay of the spectrum from the LEDs used in ATMs and personalization equipment to detect the presence of the card. Notice that the Clear Card Filter is highly transmissive in the visible light region while having very low transmission in the infrared region from 800 to 1000 nm, which includes the IR LEDs.

Design Possibilities

Using new materials means a new way of thinking when it comes to designing compelling payment cards. Cards made with the filter can be amazingly clear, that's what makes them different from standard cards. You may wish to use large, clear areas in your card design to enhance the brand building images you are portraying. You may also wish to print combinations of opaque and translucent designs, which further enhance the uniqueness of the card by contrasting with the clear.

Adding clear areas to your card appearance enables you to create more colorful and compelling designs.

Typography, solids, patterns, illustrations and photographs all reproduce well on clear plastic substrates just as with standard white opaque plastic substrates—if it works for a 4-color print job it will work here!

