



Spectrally Selective Metal Applications

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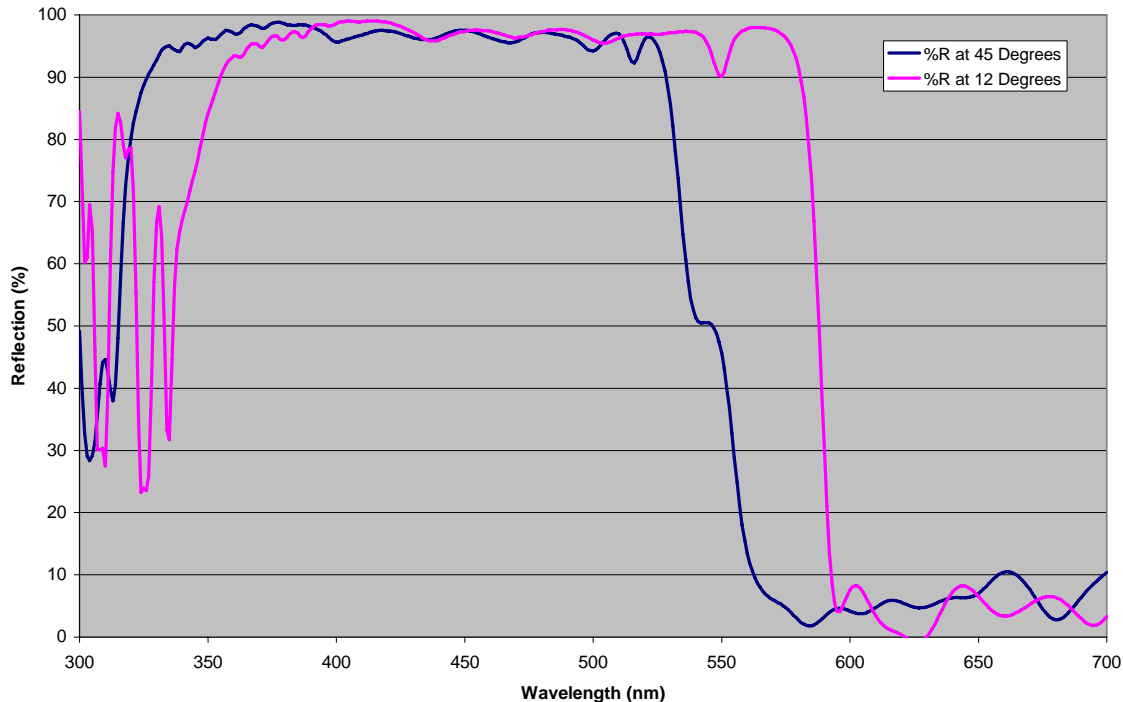
DSI has developed dichroic hybrid coatings that can be applied to metal. This application is designed to reflect specific wavelengths and couple the unwanted light into the metal substrate. The coating is constructed using two optical coatings. First a Dark Mirror stack is deposited on the metal substrate. The purpose of this stack is to couple unwanted optical energy into the metal substrate on one side and anti-reflect the outer surface of the stack. Next a dielectric stack is deposited on top of the dark mirror stack.

The dielectric stack will reflect the wavelengths that are beneficial to the system and transmit the unwanted wavelengths through the stack to the Dark Mirror. The Dark Mirror removes the unwanted wavelengths from the system by coupling them into the metal substrate where they are radiated away as waste heat.

Several application specific versions of Spectral Metal have been developed over the past 18 months. In one application Spectral Metal has been used to improve the signal to noise ratio between the excitation wavelengths and the Fluorescence wavelengths. This dielectric stack is a long wave pass filter which will reflect the fluorescence wavelengths between 350 nm and 450 nm and transmit the excitation wavelengths between 620 nm and 660 nm. The wavelengths that are transmitted by the dielectric stack are optically tuned to match into the Dark Mirror stack. The fluorescence wavelengths are reflected back into the optical system while the excitation wavelengths are transmitted through the dielectric stack, matched into the dark mirror which couples them into the metal substrate. The metal substrate then radiates them away as waste heat.

After coating the mirrors are fabricated using standard sheet metal fabrication methods. Mounting features such as slots, screw holes and tabs can be formed into the mirror after coating. The sized mirrors can be formed into precise curves and cylinders with radii as small as 25 mm. These features can reduce the complexity and cost of assembly into the finished product.

Figure 1 is a scan from a run of Spectral Metal. The substrate is mirror finished Stainless Steel 0.030" thick. The coating is designed to be high reflecting from 350 nm to 450 nm and low reflecting from 640 nm to 645 nm. The coating scan is shown at near normal incidence and at 45 degree angle of incidence. The coating is required to operate from near normal incidence up out to angles of incidence as high as 80 degrees. The mirrors are used to separate the excitation wavelength near 633 nm from the fluorescence band, from 350 nm to 450 nm, in the collection chamber prior to the light hitting the system detector.

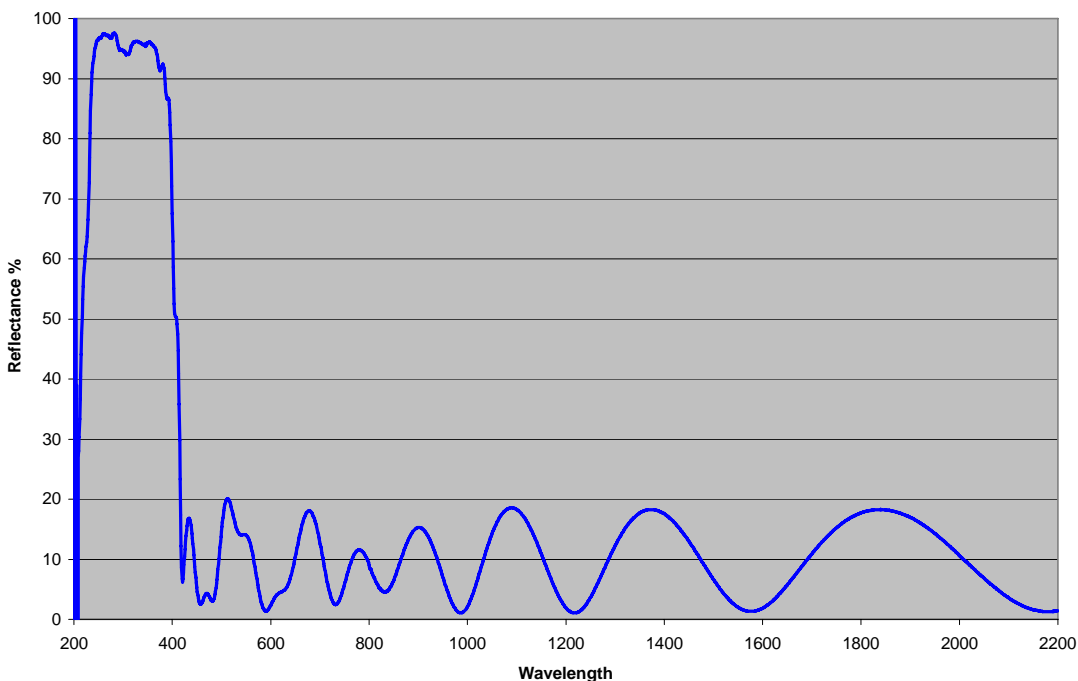
Figure 1

Another application for Spectral Metal is for the UV Curing industry. This application the goal of the optical system is to maximize the curing wavelengths between 220 nm and 400 nm and minimize the rest of the visible and infra red spectrum from 450 nm to 2200 nm. In this application Spectral Metal is used as the reflector behind the lamp. The curing wavelengths are reflected by the Dielectric stack and the longer wavelengths are transmitted through the Dielectric stack and matched into the substrate where they are radiated away as heat.

Figure 2 represents a scan from a run of this UV Spectral Metal. Spectral Metal is coated onto standard size highly polished Aluminum sheets. These sheets are cut to specific sizes per the customer requirements. With the ability to fabricate after coating, long trough reflectors can be created using multiple lengths of Spectral Metal. These lengths are placed into a frame to hold their shape. Utilizing this method, reflectors several meters long can be fabricated.

Figure 2

UV Spectral Metal at 45 Degrees Incidence

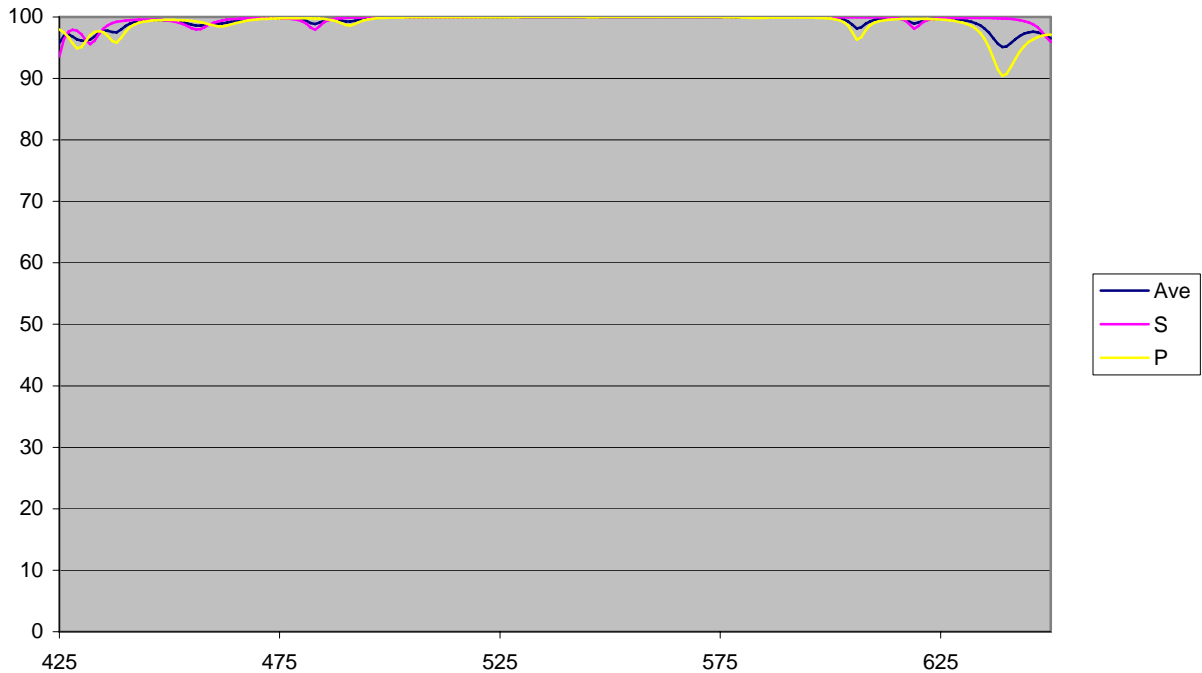


The application of Spectral Metal is beneficial in solid state lighting systems. With this application our customer is able to fabricate an aluminum extrusion of the correct curvature to properly collect the light from the LEDs. The extrusion acts as a housing for some of the electronics in the system. The Spectral Metal is formed to fit the curve of the extrusion and captured in place by features on the extrusion. The use of spectral metal in this application allowed the customer to use a relatively low cost extrusion and still have a highly reflective polished surface for efficient light collection.

Figure 3 is the performance of a mirror designed to be used with an LED illumination system. The coating is designed to reflect from 425 nm to 650 nm at a 30 degree angle of incidence. The application is LED based so the dissipation of heat was not a concern. Therefore there is no requirement to remove and specific wavelengths from the system.

Figure 3

Visible Reflector on Metal @ 30Deg



Durability:

Spectral Metal is manufactured using DSI's patented MicroDyn® reactive sputtering process so it is extremely durable. Spectral Metal coatings have been tested and pass:

- Moderate Abrasion per Mil-C-675
- Adhesion per Mil-C-675
- 24 hour humidity Per Mil-C-675
- Thermal Cycling from 0C to 50C for ten cycles.

For Further Information:

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