

Liquidmetal Alloys: Mixed Oxide Finish



LIQUIDMETAL[®]

Amorphous Alloys

Mixed Oxide Finish

The oxidized metal layer is transparent with a dissimilar index of refraction to that of the substrate amorphous alloy. Because the thickness of this very hard and transparent ceramic-like layer is on the order of the visible wavelengths of light, slight changes in the oxide layer thickness produce chromatic wavelength interference effects which result in pronounced reflected/refracted wavelengths (colors). The physics behind the perceived color is the same thin-film effect produced by a layer of oil on water as shown in Figure 1.



Zirconium-based amorphous alloys can have a functional and often colorful Mixed Oxide Finish. This finish is not a coating, paint, plating, or deposited layer of dissimilar material, but rather a very thin layer of the native metal alloy atoms which convert to their oxidized states.

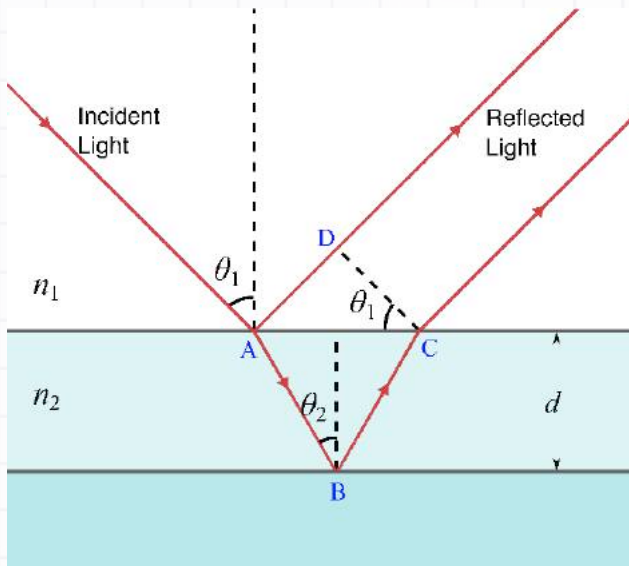
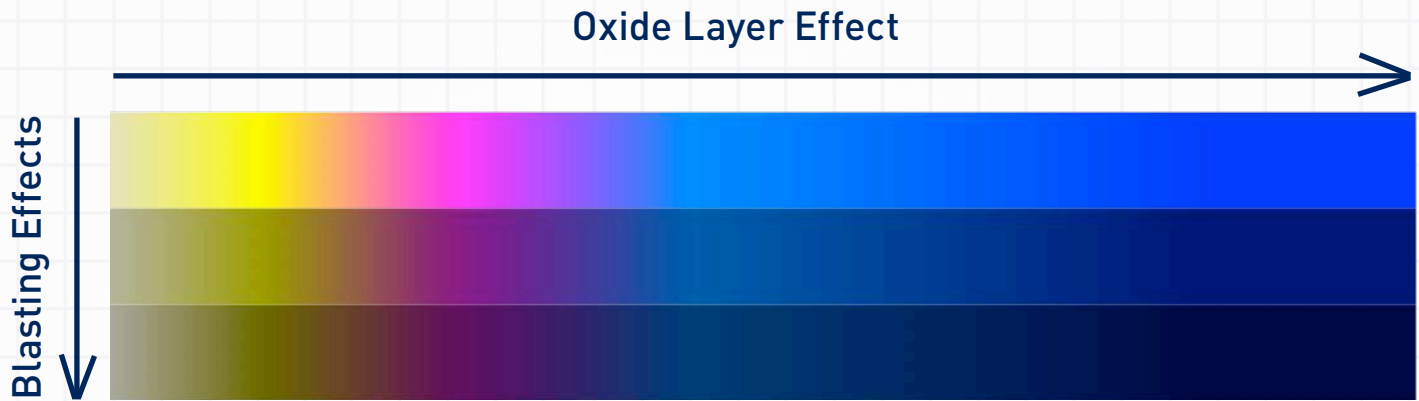


Figure 1: The thin film interference colors produced by water on oil are the same optical processes that create the Mixed Oxide Finish colors in Liquidmetal alloys

In our commercial Liquidmetal LM105 alloy, the chart in Figure 2 (on the next page) shows an illustration of the approximate colors that can be produced through this mixed oxide finish along with photographs of as-molded parts with the Mixed Oxide Finish.

Although thin (approximate thickness is 2 μm depending on the color), the mixed oxide layer is extremely hard (around 1400 Vickers) and can be effectively used to resist scratching, wear, or other abrasive environments.

LM105 OXIDATION SPECTRUM (ILLUSTRATIVE)



As Molded

L*: ~78
a*: ~0.8
b*: ~5
Ra: ~0.5 um

Blasted + Oxidized

L*: ~35
a*: ~-2
b*: ~-12
Ra: ~0.5 um



Figure 2: Illustration of color range that can be achieved with Liquidmetal's Mixed Oxide Finish. The L*a*b* color space values for the bright and dark ends of the spectrum are given. Darker colors are obtained by media blasting the parts before the Mixed Oxide Finish process is complete.