

The Enhanced Thermal & Solar Reflectance of InvariMatte® Stainless Steel



Beyond the sustainability of the finish, characteristics of a given stainless steel surface weigh heavily in the solar reflectance equation. Particular attention is paid to Contrarian Micro Textures' InvariMatte® stainless steel finish, which was designed for roofing and other building envelope applications. While the original objective in developing this product was to create a uniform low glare finish that would not produce unwanted environmental glare when used in large surface areas such as a roof, the energy investigation we have undertaken has shown distinct advantages of this finish as it relates to energy performance.

This was first witnessed by experiencing a lack of reflected heat atop an InvariMatte roof during a site visit on a 118°F day in full sun. Inspectors were able to place their hands comfortably on the metal surface. This experience led to the discovery of stainless steel's contribution to energy savings and heat island mitigation.

A roof can be high maintenance part of a building, especially as it ages. One of the great, unanticipated benefits of the InvariMatte stainless roof on the DLCC is that it has required absolutely no maintenance in its lifetime. It probably never will. This building just received a Platinum award from LEED for maintenance and operations. Its management is happy that the roof has never been a source of difficulty. Interestingly, the same 304 stainless with an abraded finish on exterior wall panels has soiled sufficiently that expensive hand cleaning was required for the hosting of the G20 meetings there several years ago.

Among stainless steels there are important differences with regard to micro-finish and therefore the ability to stay clean. Abraded surfaces are rather jagged on the microscopic scale. They can snag and hold debris. It is preferable to have a rolled surface wherein variations are controlled. InvariMatte is such a rolled-in finish with a surface that is 75% in the as-cold rolled, as-pickled condition. The other 25% consists of smooth depressions spaced to scatter, but not absorb visible light. The depressions are sufficiently shallow and rounded so that they cannot entrap the vast majority of atmospheric dust, soot, ash, etc. This surface does have high surface energy so it is wet by water. This means any dissolved pollutants do not concentrate on drying. It makes the water behave as if it has been treated with a surfactant; it makes the water sheet instead of bead up. Precipitated compounds cannot aggregate to form hard water spots. Some surfaces rolled to coarser finishes, as in the case of the "linen" finish, have low energy and small pockets. They don't have the same avoidance of dirt and precipitates. This is why roofs like that on the David L Lawrence Convention Center (DLCC) have the same appearance after ten years of exposure to the air of one of the more polluted regions in the US.



InvariMatte® stands by itself as the premium roofing material. Its high reflectivity of solar radiation gives it the industry's highest SRI of 113, when measured using the alternative method to that used for painted surfaces. Its unique self-cleaning surface and resistance to corrosion keep that SRI at the same level for over 10 years without cleaning or maintenance. Despite this, it is not shiny; it has a gloss near less than that of some paint finishes. How does it do this?

InvariMatte® has a surface which is engineered on a micro scale. Very smooth and shallow indentations are randomly spaced on the surface at a separation of an average of 100 to 200 microns. The indentations average about 50 microns and are half that in depth with rounded contours. The surface of InvariMatte® is self-cleaning, or hydrophobic. This produces a diffractive array which

interferes with the reflected light from the 80 to 90% of the surface which is smooth. The result is destructive interference of the reflected light which makes the surface appear as a matte finish while keeping high solar reflectivity.

The small, smooth indentations create a surface with high surface energy, which makes it very wettable. Water doesn't bead on the surface; it smooths out. As with dishwasher wetting agents, this prevents concentrations of hard water deposits, which dull and discolor other stainless surfaces, such as linen-type surfaces. The indentations are too shallow to harbor soot, so rain rinsing removes airborne contaminants. Thus InvariMatte® keeps its brand-new look year after year without maintenance.

The high reflectance and the natural low emissivity of bare metal, about 0.2, also mean InvariMatte® is a radiant barrier. This gives the single layer of stainless InvariMatte® a savings of 20 to 30 in R value over a dark roof or an aged white roof.

