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PVC weatherability



Xenon Arc Accelerated Weathering Study

Accelerated weathering resistance test methods are very difficult to correlate with the results of end use experience, because there is no such thing as standard outdoor environment which will always give the same results and at the time be representative of all outdoor aging. The various factors affecting the weathering resistance are location, duration and intensity of sunlight, temperature, moisture, humidity, rain, snow, pollution and many other things.

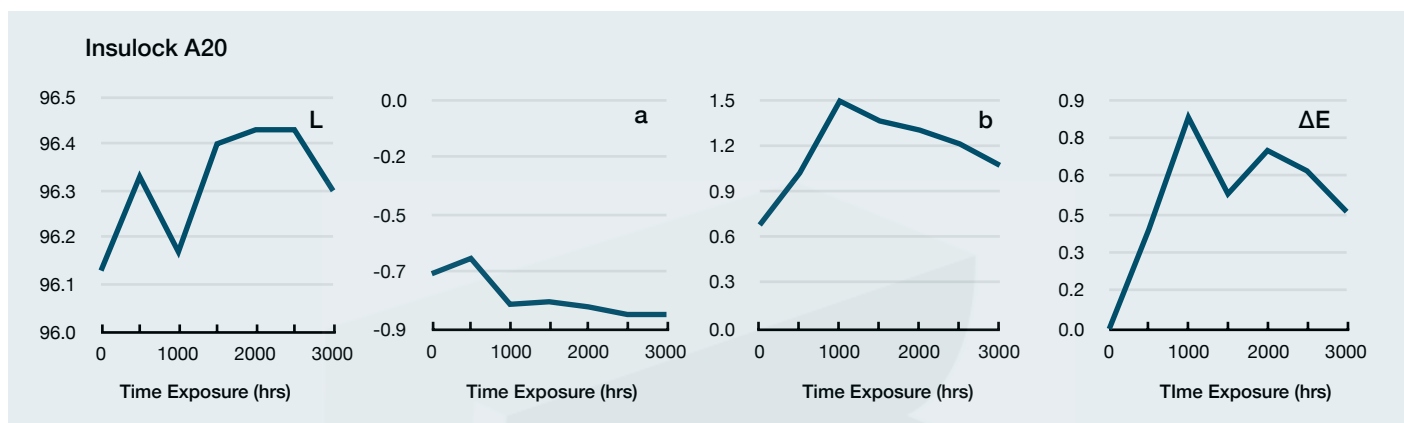
The most important cause of degradation in most outdoors environments is the UV portion of sunlight, especially in the range of 295-350nm, peaking at 320nm for PVC. Xenon arc lamps are used for solar simulation in the spectral region below 500nm. The xenon arc test weather-ometer is a light exposure apparatus with and without water for exposure of plastics. The ΔE value from this represents weathering resistance in form of colour change development. ΔE value of less than 1 practically can not be visualised by naked eyes, therefore would be considered excellent especially after 3000 hours (125 days) under xenon-arc lamps representing approximately five years outdoors

Interpretation Xenon Arc accelerated Weatherability Test Results

Insulock A20 and A30 samples were exposed to accelerated weathering using Xenon arc weathermeter. The change in colour developed due to accelerated weathering was measured using the Hunter Colourimeter.

The Hunter L, a and b opponent colour scales gives numerical system to define colour change. Theoretically, a colour can't be green and red at the same time or yellow and blue at the same time; though it can be both red and blue as in purple, red and yellow as orange.

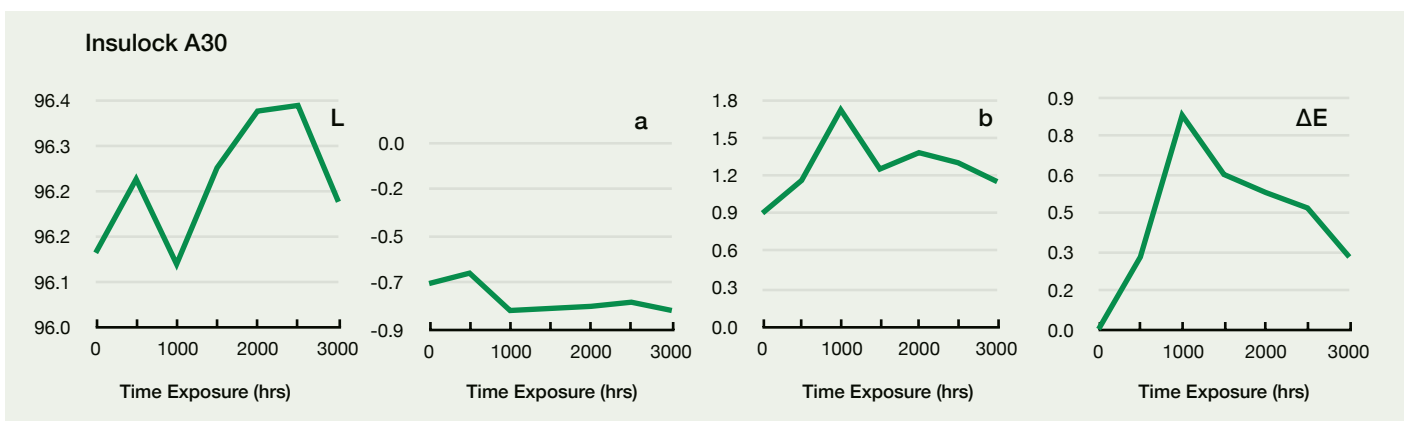
Thus red and green can be represented as single number, **a**, which is positive if the colour is red and negative if the colour is green. Similarly, yellowness or blue is expressed by coordinate **b**, which is positive for yellow and negative for blue. The third coordinate describes the lightness of the colour and is designated **L**. Colour space is three dimensional and colour difference can be estimated in terms of difference between pairs of points in space.



With rectangular coordinates, the formula is:

$$\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2}$$

ΔE thus becomes a non directional number signifying the extent of colour change. It represents overall colour change. After 3000 hours of Xenon Arc weathering the ΔE value for Insulock samples was less than 0.5 ΔE value of less than 1 practically cannot be visualised by the naked eye.



U.V. Resistance

UV-initiated PVC degradation results in dehydrochlorination and accompanying discolouration such as yellowing or browning. This is caused by oxidation of PVC, formation free radicals, and formation of double bonds, leading to molecular chain breakdown.

The effects of photochemical decomposition are similar to those found as a result of thermal degradation. Therefore in order to achieve good weathering properties including good UV resistance, heat stabiliser is a primary additive used in PVC. For example TM181, a kind of efficiency liquid methyltin mercaptide stabiliser used in our product, provides excellent long term colour and impact strength retention in outdoor applications.

In addition of heat stabilisers, UV stabilisers can protect PVC from photo degradation by absorbing UV light of wavelengths from 295 to 400nm and dissipating the light energy harmlessly in the form of heat. Benzotriazole type and hindered amine light stabilisers (HALS) are commercially important light stabilisers for PVC applications, such as Tinuvin 328 and Chimassorb 944FD.

TiO₂ in PVC is not only a pigment but also possesses UV absorbing qualities.

Please note: These tests are only applicable to White A20 & A30 PVC jacketing and fittings. Coloured jacketing and fittings are not suitable for outdoor use or internally where it would be exposed to direct sunlight.