Quick Links

Drawing on decades of weathering leadership and expertise, the Atlas Consulting Group provides in-depth consulting services that assist you in developing and applying the best weathering test methods and strategies for your products. ***Atlas Weathering Consulting Insights*** offers interesting and valuable information on a variety of topics relevant to long-term durability testing.

Weathering Testing 101 - Back to Basics
The Question on Everyone's Mind

This issue of the Atlas Weathering Consulting Insights Newsletter is the third installment of a four- part series that will briefly address four of the most frequently asked questions that the Atlas Consulting Group receives in regards to weathering testing.

"How long do I need to run my weathering test?" is a frequently asked question. For outdoor tests the answer seems relatively straight forward using the simple calculation that one year of South Florida exposure takes about 365 days of exposure at our Homestead (Miami), FL site. However, even this simple rule has caveats regarding test specimen orientation, sample backing, etc., as compared to the product's service use conditions, test starting date, and other factors.

More often, this question is asked in outdoor or laboratory accelerated weathering as it is important for planning to know when to end the test. However, determining that is usually not a simple task for a variety of factors, as has been described in the first two installments of this series Consulting Insights issues 16 and 17. However, both for static outdoor or accelerated weathering exposures, the larger issue of factors that go into determining the exposure length is more complex and factors in material-specific properties.

Degradation Curves Are Important

Take for example the case of a simple hypothetical material property degradation versus exposure duration (Figure 1).

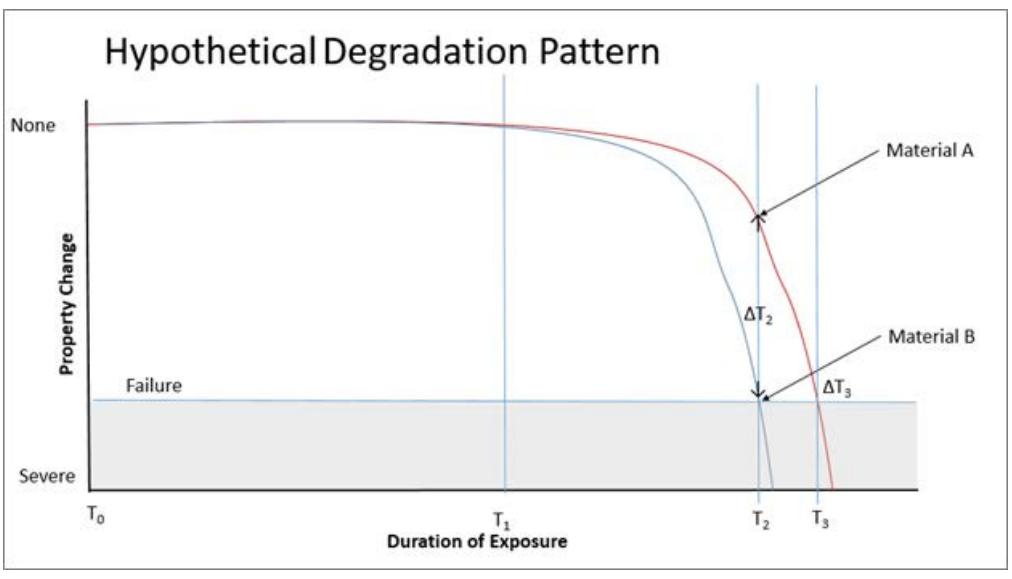

Figure 1. Hypothetical property loss versus weathering exposure for two similar test specimens

First, as is clearly evident, property loss is not linear with the total exposure time, although the rate of property change between the two materials is both fairly linear and of the same magnitude. In short, if we were to "time shift" the Material A curve slightly to the left, the two curves would line up. So it is really the "induction time" to where the curves diverge at T1 that is different, although the rate of change is essentially the same.

Note that the difference in the measurement property is quite large between the two materials at the T2 exposure interval. Being on a steep slope, a slight shift left or right would have a large effect on the difference (delta, Δ) between the two measurements. This makes the point between T1 and T3 that is selected for a measurement really critical. Although shown as continuous lines in the illustration, in reality, these are only curve fits between actual measurement data points. So it is easy to miss rapid property changes; if measurements were taken only at T0, T1 and T3, both materials would have reached "failure." If taken at T2 instead of T3, Material A would have looked vastly better, but, in reality, failed just after Material B. It is entirely possible that the exposure difference between T2 and T3 is within normal test variability and there is no real difference between the materials.

Test to Failure

If the above test had ended at T1, the result for the two materials would be identical. There is always a great risk of ending a test at a pre-determined endpoint (hours, months, Joules/m^2, AFUs, etc.) if no property change of interest in observed. You don't really then understand the "robustness" of the product. In other words, was it going to "fall off the cliff" had the test continued just a little longer, or was there a wide safety margin? In the former, a slightly harsher service environment could be enough to cause the product to fail prematurely.

In weathering, the guidance is always to "test to failure" because if you don't do that, you don't really know if you have a really good product or a very poor test, nor do you understand the durability of the product. This is true even if you are only required to meet some minimum performance target such as a supplier or material rating specification. So, if we can offer any testing guidelines, among them would certainly be to ask yourself if you should:

- Test to failure rather than to a pre-determined endpoint
- Take more frequent measurements to understand the true degradation characteristics
- First determine how you will evaluate material test results – taking into account test and measurement error and variability
- Use sufficient replicates to account for normal variations in prepared test specimens

If these questions are ones that you are struggling to find the answers to as they relate to testing your product, the Atlas Consulting Group can assist. We can help you select the appropriate standards or develop the test cycles, test methods or complete testing programs that are appropriate for both the product you are testing and its intended end-use environment(s).

To view or download past issues of the Atlas Weathering Consulting Insights Newsletter click here.

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